European Commission
Directorate-General Environment

The costs of not implementing the environmental acquis

Final report
ENV.G.1/FRA/2006/0073

September 2011

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List of abbreviations

AQFD	Air Quality Framework Directive
BAT	Best Available Technology
BWD	Bathing Water Directive
CA	Competent Authority
COM	European Commission
DWD	Drinking Water Directive
ETS	Emissions Trading System
GDP	Gross Domestic Product
GES	Good Ecological Status
GHG	Greenhouse Gas
IAS	Invasive Alien Species
IPPCD	Integrated Pollution Prevention and Control Directive
LCPD	Large Combustion Plant Directive
MS	Member State
MSW	Municipal Solid Waste
NECD	National Emissions Ceilings Directive
OECD	The Organisation for Economic Co-operation and Development
RBMP	River Basin Management Plan
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (EU regulation on chemicals)
ROHSD	Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
UNEP	United Nations Environment Programme
UWWT	Urban Wastewater Treatment
UWWTD	Urban Wastewater Treatment Directive
WFD	Water Framework Directive
WTP	Willingness to pay

Executive summary[1]

Background

This report focuses on the costs of not implementing the EU environmental acquis. The EU has introduced important legislation to improve the quality of the European environmental acquis and not all the key legislation has been implemented evenly and fully throughout the 27 Member States.

There is an increasing focus on making sure that all EU legislation is implemented properly in all the Member States. The current EU Commission has implementation and better enforcement as one of its top priorities.

Objective

The objective of this study is to assess the costs that arise from this less than full implementation. The study aims to provide an overview of the implementation gaps and the associated costs by identification of the most important costs elements.

It should be noted that the study does not look at any "savings" from not implementing the environmental acquis. Member States might argue that lack of resources or competitiveness issues are reasons for not implementing certain requirements. Any such saved compliance costs are not addressed in this study. It is aimed at highlighting the often less visible costs of not implementing the legislation.

Focus and approach

The implementation gap has been defined as including:

- The gap between current legally binding targets and the current level of implementation
- The gap between agreed future targets and the current level of implementation.

The gap between agreed future targets and the current implementation **does not constitute any legal compliance gap** but it is interesting to cost such a gap. Having a deadline in for example year 2015 or 2020 does not mean that Member States should not attempt to achieve the target at an earlier date thereby realising the environmental benefits of the target.

The legislation is not always prescribing a quantified target. The noise legislation, for example, calls for developing action plans that can reduce the exposure

[1] The data collection and analysis for this study was mainly done before March 2011

to noise. This assessment included the costs of not reducing such exposure though it might not be that there is a legal compliance gap.

The study assessed the implementation gaps focusing on the following environmental sectors:

- Waste
- Biodiversity and nature
- Water
- Air
- Chemicals and noise (less detailed).

For each sector a desk study has been made and the key results in terms of the implementation gaps and the associated costs have been identified and described.

The assessment focused on the overall policy objectives and targets within each sector and not the specific compliance with individual directives. The number of individual pieces of legislation is large as the environmental acquis includes more than 300 directives and regulations. Hence, a detailed account of all legislation is not possible.

Implementation gaps

The available data and indicators suggest that there are implementation gaps across most of the environmental sectors and in almost all Member States.

- In the waste sector there are large gaps in relation to waste recycling and waste prevention. Though the trend is to recycle or recover more waste and landfill, there are many gaps in relation to achieving both already binding targets as well as agreed future recycling targets. Too much waste is landfilled in many Member States including the use of sub-standard sites. Enforcement of the legislation on shipment of waste is an issue as up to 20% of the waste shipments might be illegal.

- In the field of biodiversity/nature there are some gaps in the designation of Nature 2000 sites and, most importantly, the 2010 and 2020 targets of putting an end to biodiversity losses have not been achieved.

- Concerning the local air quality there are relatively large implementation gaps and the gaps cover most Member States. The gaps are both in relation to the current policy targets and to the agreed future targets.

- For water there are some gaps in compliance with the key water quality legislation in relation to current targets. For agreed future targets such as those included in the Water Framework Directive there are obviously bigger gaps.

- For other sectors such as chemicals and noise, there are few quantifiable targets against which to measure the level of implementation. Key legislation, for example REACH, will only have full effect in the future and its harmonised implementation reduces the risk of significant gaps. For noise, a significant share of the urban population is exposed to noise, but the legislation does not specify quantitative reductions for example in terms of number of people exposed.

Costs of implementation gaps

The costs associated with the implementation gaps comprise many types and they are not all easy to quantify. The main costs of not implementing the environmental acquis are the not realised environmental benefits of the legislation, see Table 0-1.

Table 0-1 Costs on not implementing environmental acquis - future targets in billion EUR per year

	Costs (future targets) billion EUR per year	Comments
Waste	≈ 90	Not realised environmental benefits (including GHG reductions) and value of recycled material
Biodiversity/ nature	≈ 50	Very uncertain - may be an overestimate - indicates an order of magnitude based on the GDP share of the global loss.
Water	≈ 5 - 20	Based on WTP for "good ecological status" from a few Member States (MSs) - spill-over effects on bio-diversity and nature not included. The Flooding and the Marine Directives might also add to the costs.
Air	≈ 20 - 45	Include acute health impacts (mortality and morbidity). The limit values for PM, ozone and NO_X are exceeded in zones where 20% - 50% of the EU population lives
Chemicals (REACH)	≈ 4 - 5	Benefits of REACH based on the assumed share of illness caused by exposure to dangerous substances - uncertain estimate. Long-term effects of chemical legislation could be much higher.
Noise	≈ 0 - 40	Health impacts of noise exposure, actions plans would not necessarily eliminate all the costs.
Total	**≈ 200- 300**	**An order of magnitude estimate**

Source: See Part B for details on each sector.

The above estimates are for full compliance with agreed legislation where some targets might be 2015 or 2020. The costs associated with implementation gaps in relation to targets valid today are less though it is difficult to quantify by how much. The costs can be assessed assuming that for waste about one-third relates to current targets, for water only a small share while for air a larger share (maybe half the costs) and possible over-estimation of biodiversity cost. **As an**

indicative estimate, the costs of implementation gaps in relation to currently legally binding targets could be around 50 billion per year[2].

Quantifications of environmental benefits are always subject to large uncertainty. The above estimates are even more uncertain than normal as there are no precise figures for the implementation gap.

- The estimates of each sector are based on more of less the same basic approach being the environmental damage costs of not achieving the full effect. The specific approaches differ due to the nature of each sector.

- It is difficult to use the estimates to make judgements about which sector is having the largest costs due to implementation gaps. The costs of not implementing the water legislation might be underestimated. For example, the costs related to implementation gaps of the flooding and marine legislation have not been quantified and there could be significant spillover effects to biodiversity and nature. Implementing all the necessary measures to achieve the Water Framework Directive (WFD) objectives could reduce the costs related to biodiversity and nature so part of the costs assigned to that sector should perhaps be seen as costs related to water legislation implementation gaps.

Impact on industry

The impact on businesses from the uncertainty about implementation of the environmental legislation could be substantial. These costs are less easily quantified, but they should not be neglected.

[2] Many Member States have time derogations which make it very complex to estimate the current "legal" implementation gaps. Several of the assessments of the costs of not implementing the existing legislation have a future reference year - for example 2020 as in the case of the waste assessment.

- One effect is on the eco--industries. Studies suggest that uncertainty about the environmental policy affects innovation in environmental technologies. Such innovations are very important as they can reduce the costs of compliance and they can create new markets and job opportunities. The EU27 eco-industry is estimated to have an annual turnover in excess of 300 billion EUR so it is clear that if uncertainty about implementation of the environmental legislation affects the industry by just a few percentages, this amounts to significant costs.[3] A recent study on the costs of not implementing the waste legislation has estimated that full implementation of all waste legislation would lead to an additional waste (and recycling) industry turnover of 49 billion and an additional job creation of about 600,000 jobs.[4]

- The uneven implementation across Member States distorts competition among EU industries as it means different compliance costs. Lack of implementation can also lead to additional administrative costs if standards vary across Member States. These effects are less well documented compared to the impact on the eco-industries.

Costs of infringement procedures

The costs of non-compliance include the costs related to infringement cases.

- The implementation gaps create additional and unnecessary costs for competent authorities in the Member States. In 2009 there were 451 infringement cases related to environmental legislation. Each requires time and resources at the relevant Member State authorities. If the case is brought before the European Court of Justice, the financial penalty is likely to be in the order of several million euros and the level is increasing.

- The effect of an infringement case or the risk of facing one could be that certain measures needs to be implemented in an accelerated manner compared to a more "normal" compliance implementation. If investments have to be made over a very short time span, they are likely to be more expensive. Hence, if implementation gaps are due to no implementation activity, there is a risk that compliance costs could be higher than if the implementation had been better planned.[5]

Gross and net effects

This study is focusing only on the costs of not implementing the legislation. Full implementation would also create additional costs for Member States (typically additional enforcement costs) and for industries that have to invest in

[3] The technical progress in the green sectors has been 4-10% compared to the average technical progress of 2%. If lack of innovation leads to 1% lower technical progress, it would amount to about 3 billion EUR annually given total turnover of 300 billion EUR.

[4] Bio Intelligence Service 2011, "Implementing EU waste legislation for green growth". The results are based on comparing full implementation to the implementation status by 2006.

[5] Ex-ante analysis will often show that if industry is given a reasonable time to implement new measures, costs are significantly lower than when the time frame is very short. There are few documented examples of this effect, but in the water section, there is an example of how compliance costs could be affected by the time frame.

the necessary compliance measures. The consulted studies seem to suggest that for most sectors the monetised cost of not implementing is significantly higher than the cost of implementation, meaning that the benefits of the legislation are much higher than the costs.

The large number of individual pieces of legislation makes it difficult to summarise the overall implementation situation. Figure 0-2 does so, but within each area there is legislation that is almost fully implemented and legislation where there are gaps.

Table 0-2 Overview of results

	Implementation gap in relation to current targets	Implementation gap in relation to future targets	Environmental and health costs	Uncertainty, market distortions etc	Spill over effects
Waste					
Prevention	No specific targets	Large potential	Reduced lifecycle costs		Reduced lifecycle GHGs
Recycling	Most MSs in compliance	Many MSs need further improvement	Recycling prevents some lifecycle costs	More certainty for recycling industry	Reduced lifecycle GHGs
Disposal	Many dumpsites in some MS		External costs of landfill		Methane gas from landfill
Nature					
Bio-diversity loss	Significant loss	Significant loss	The value of the loss is substantial		Spillover to water and climate change
Water					
Freshwater	Point and diffuse sources exceed requirements	Many water bodies will not comply	Not realised benefits of good ecological status	No general costs	Spillover effect to biodiversity and nature
Marine	No specific targets				
Flooding	No specific targets		Large costs of flooding could be reduced	High economic values at stake at flooding events	
Health	Generally high compliance				
Air					
Ambient air quality	Air quality standards exceeded in many cities	Most MSs need further emissions reduction to comply with future targets	Many premature death and other health costs		Potentially not realised GHS reductions

Significant gaps in several MS/Relatively large costs
Mixed situation with gaps in some MS/Some costs
Few gaps or limited importance of gaps/limited costs

1 Introduction[6]

1.1 Background

Focus on implementation

This study is part of the Commission's focus on implementation of existing environmental legislation. Better implementation and better enforcement are focus areas for DG Environment now, and the study aims to provide a better understanding of the losses that result from less than full implementation.

The Commission's principles and approach on "enforcing" the EU legislation include for example to act quickly on implementation gaps regarding key provisions. They also involve adopting a partnership approach to ensure the overall good implementation. A new important tool in addressing the challenge of better implementation is the EU Pilot approach which is a "partnership" approach for Member States which are seen to be non-compliant with EU legislation.

Policy coherence implies equal conditions and equal treatment of all which is also a reason why better implementation throughout the EU is important.

1.2 Objective

Purpose of study

The purpose of this study is to assess the costs of not implementing the current environmental *acquis* in the EU27 Member States (MSs). This should include the environmental, economic and social impacts from not meeting the set environmental objectives.

The focus in this study is on the "missed" benefits and the "friction costs", i.e. the results from not full implementation of the environmental *acquis*. Thus, the study should look at missed environmental and health benefits in cases of non-compliance and at missed positive spillover effects (again: missed benefits) to other policy areas including missed EU Single Market benefits. As regards friction costs, these will relate for example to the costs of infringements.

Challenges

The large number of directives and other legislation has been one the main challenges of the study. Also the lack of quantitative data on some of the environmental areas has restricted how far the cost assessment has been able to derive monetary values for the costs of implementation gaps. Certain types of

[6] The data collection and analysis for this study was mainly done before March 2011.

costs are less well covered in previous studies and impacts assessments, but could be important costs of incomplete implementation. (For example: Impacts on industry related to level-playing fields of the Single Market, uncertainty for industry on exact requirements etc).

Organisation

The report is organised in two parts. Part one which is the main report, and part two (appendices) which comprises a more detailed analysis of each environmental sector.

- Part one:
  - Chapter 1 Introduction
  - Chapter 2 Assessing the costs
  - Chapter 3 Findings
- Part two (appendices):
  - Appendix A Waste sector
  - Appendix B Biodiversity/nature
  - Appendix C Water sector
  - Appendix D Air sector
  - Appendix E Other sectors
  - Appendix F Litigation costs

1.3 Definitions

The key definitions are presented here.

Implementation gap

The implementation gap is defined as the difference between the actual implementation and full implementation.

Full implementation

Full implementation is analysed for two different scenarios: one for the environmental targets that should have been achieved by now and on for the targets that have been defined for the future. Some Member States have time derogations and some key policies have deadlines only in the future, but in all cases, the environmental targets are defined as something that should be achieved by that certain date. Therefore, Member States could in principle implement the targets before the required deadline. As long as the targets are not achieved there are environmental costs. These costs are included as costs of not implementing the target even when there is no formal legal implementation gap.

Costs

The costs of not implementing the environmental legislation are defined as the benefits of the policy that are not realised plus the costs related to the uncertainty and friction that is created by the lack of implementation. The study is not looking at the compliance cost of the environmental acquis.

2 Assessing the costs of not implementing the environmental acquis

This section describes the approach to assessing the costs of not implementing the acquis, starting with the key legislation and then defining what implementation gaps are and finishing with identification of the main cost elements.

2.1 Identification of relevant legislation

The below table includes the specific directives that have been considered. It will not be possible to cover all directives in detail. This list includes the most relevant key directives within each sector in terms of possible implementation gaps.

Table 2-1 List of relevant legislation

Area	Directives	Comments
Water	WFD	Main compliance by the 2015 deadline, but further time derogations possible.
	DWD	Most MS in compliance with regard to larger water supplies, small water supplies often not in compliance.
	UWWTD	Most Old Member States in compliance - several southern European MS not in compliance - new MS has time derogations.
	Nitrates Directive	Varying degree of compliance - most MS are formally in compliance though the effect on total nitrogen loads might be insufficient to reach good water quality.
	Bathing Water Directive	Compliance is relatively high, i.e. above 90%.

Area	Directives	Comments
	Other water legislation	New initiatives on marine waters and flooding - no deadlines passed yet.
Waste	Waste Framework Directive (2008/98/EC)	Sets out the waste hierarchy - no quantified targets on prevention in the Directive but might be included in future National Prevention plans. Additional quantitative recycling targets for construction/demolition and municipal waste.
	Hazardous Waste Directive	No quantitative targets - difficult to assess compliance. Reach and mainly ROHS Directives should reduce production/hazardousness of waste.
	Waste Shipment Regulation	Formally high compliance - cases of illegal shipment could be an indicator.
	Landfill Directive	Lack of compliance regarding landfill standards and fraction of biodegradable waste going to landfill
	Incineration Directive	The directive sets emission limits - in principle compliance can be quantified - close link to the Integrated Pollution Prevention and Control Directive (IPPCD).
	Waste stream legislation	More than 10 waste streams regulated by specific directives - several examples of non-compliance and few examples of MS performing far better than the EU minimum targets
Air	Air Quality Directive	New directive that merge the Air Quality Framework Directive (AQFD) and daughter directives. Quantified target for air quality and data on exceedances can be used to quantify non-compliance.
	Integrated Pollution Prevention and Control Directive (IPPCD)	Data on permitting progress - difficult to quantify Best Available Technology (BAT) and national implementation.

Area	Directives	Comments
	Other industrial emissions legislation	The Large Combustion Plant Directive (LCPD) sets specific targets or emission limit values for assessing and quantifying compliance.
	National Emission Ceiling Directive (NECD)	The directive sets the overall targets for emissions and compliance can be quantified by for example exceedances of NO_X emissions.
Nature and biodiversity	Habitats Directive	The MSs have to a various degree designed protected habitat sites.
	Birds Directive	The MSs have to a various degree designed protected bird sites.
	Biodiversity Action Plan	The aim of the plans of 2001 and the update in 2006 was to stop the loss of biodiversity by 2010.
Chemicals	REACH	No compliance status yet (registration status could be used to asses current implementation).
	Other chemicals legislation	Biocides, pesticides etc sets out harmonised criteria for chemical products. Compliance cannot be quantified.
	Seveso II Directive	Protection against major accidents. No quantified targets and generally, the MSs are in compliance.
Noise	Directive on Environmental Noise	No quantified limit values - require mapping and action plans.
	Other noise legislation	There are various directives and requirement on noise from specific sources e.g. road vehicles. Generally harmonised rules and compliance.
Civil protection	Various legislation	The main aim of the EU is to coordinate and support cooperation in cases of emergencies. No specific implementation issues to address.

2.2 Implementation gaps

Policy targets

The implementation gaps are assessed not by each piece of legislation, but by the overall policy objectives/targets within each environmental area. In some cases these objectives are linked closely to one particular directive, but in most cases several directives contribute to achieving the overall objective.

The policy objectives/targets that are used as indicators to measures the implementation gaps are displayed in the below table. For example for the water sector legislation, a key policy objective (freshwater and groundwater) is a good ecological state (or potential) which is to be achieved through various directives and the associated measures.

Table 2-2 Policy objectives/targets used as indicators for implementation gaps

Environmental sector	Policy targets/indicators
Waste	Waste prevention Specific recycling rates (for selected waste streams) Disposal (use of non-compliance landfills)
Biodiversity/ nature	Integration and sustainable use of resources Overexploitation Fragmentation and green infrastructure Nature conservation Invasive Alien Species (IAS) Contribution to global biodiversity
Water	Good water quality (good ecological status) Protection of the marine environment (good ecological state) Prevention of flooding ("disaster prevention" - reduction of the risks of flooding/effects of flooding) Sound health protection (drinking water and bathing water)

Environmental sector	Policy targets/indicators
Air	Air quality (PM, SO_2, NO_2, Lead, Ozone, PAH, CO, Benzene, As, Cd and Ni)
Chemicals	Safe use of chemicals and phase-out of most hazardous ones
Noise	Number of people exposed to noise

Current and future gaps

The implementation gaps have been analysed with respect to:

- The gap between currently legally binding targets and the current level of implementation
- The gap between agreed future targets and the current level of implementation.

In most of the environmental sectors, specific future targets have been agreed which will imply significant improvements. A future target meaning that certain improvements should be in place before 2015 or 2020 does not prevent any MS from achieving the improvement before the deadline. Therefore any day that passes where environmental improvements are not realised means that the MS incurs a cost though there is no issue of non-compliance from a legal perspective.

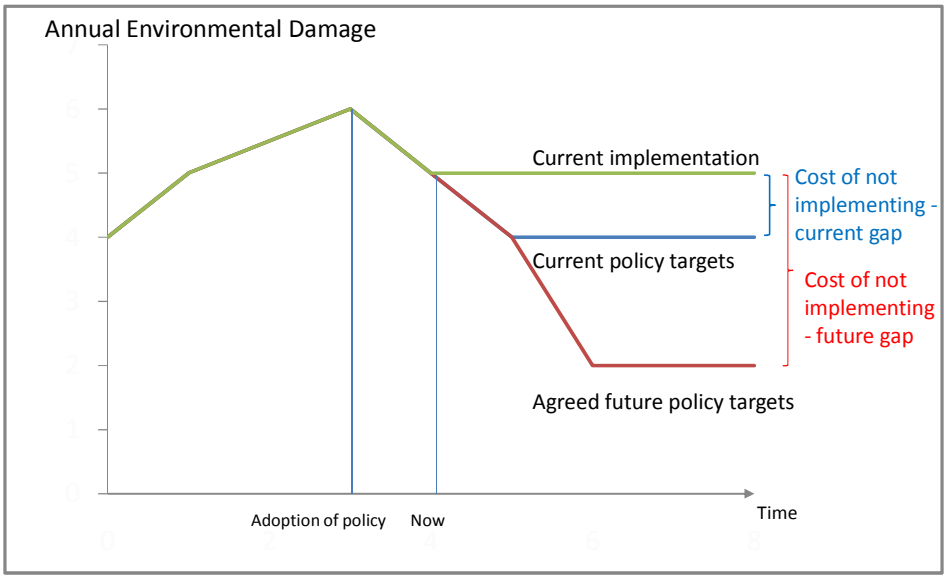
2.3 Assessing the costs

2.3.1 Introduction

Cost concepts

Figure 10-1 illustrates that the current EU policies reduce the environmental damage (compared to a no-policy situation) and that the agreed future policy targets will further reduce the annual environmental damages and losses. Current policy implementation is uneven and partial which means that the reduction of the annual environmental damages has been less than required by the current polices.

Figure 2-1 The costs of not implementing the acquis in relation to current targets and future agreed targets



The illustration is a simplification - for example continued economic growth could mean that the annual environmental damages will increase unless new policies are put in place.

Types of costs

As it is described under each environmental sector, there are significant costs of not implementing the environmental acquis. Though not all cost elements are easily quantifiable or can be monetised, there is substantial evidence on most of the environmental sectors.

The cost elements are organised in the following way:

- Environmental and health costs[7]
- Uncertainty, innovation and competition costs
- Spillover effects
- Administrative costs to industry
- Litigation costs.

The approach to assessing each cost element is described in this section. Note that the cost of non-implementation is lower than the cost of environmental damage. This is because targets are usually not for zero pollution or environmental damage.

[7] There could be a link between the actual implementation level and the future target so if implementation is slow, future targets are adjusted downwards. This effect is not included here as it concerns the determination of the targets. They could for example be adjusted if implementation turns out to be more costly.

2.3.2 Environmental and health costs

Not surprisingly, the most important cost category is the benefits of the policy that are not realised. Most of these benefits are environmental benefits though health benefits are also important for some of the environmental sectors.

The environmental and health costs can be estimated by assessing and valuing the implementation gap. For most sectors the environmental gap is the difference in environmental quality between the current situation and full implementation. If this quality indicator can be valued or even monetised, the environmental and heath costs can be estimated.

As there are many environmental and health benefits that cannot be quantified or monetised, any account of the environmental and health costs related to implementation gaps will tend to underestimate the true magnitude of the costs.

2.3.3 Uncertainty, innovation and competition costs

There are several important impacts of implementation gaps related to functioning of markets. These market impacts from uneven and partial implementation of the environmental acquis will be different for the eco-industries and all other industries.

Eco-industries

The impacts on the eco-industry are likely to be very significant. Implementation gaps mean that the demand for environmental goods and services is less than it would have been at full implementation. This might indicate that some economies of scale are not exploited. The uneven implementation also affects the level of innovation which leads to too expensive or less efficient goods compared to a situation with full implementation and a higher level of innovation.

Innovation

Uneven and partial implementation of the environmental policy can have an impact on innovation in pollution abatement technologies or in cleaner technologies. Research made by the OECD has shown that[8]:

- The ambition level of the environmental policy affects the level of innovation (measured by patent applications)
- The stability in environmental policy affects the level of innovation.

It means that both a low level of ambition and the uncertainty about when and what requirements will be introduced affect innovation.

Innovations in "green" technologies are important as they can reduce the future costs of achieving the environmental goals and lead to the development of new/improved goods/services that can create jobs and export revenue.

[8] OECD 2009; *Environmental policy framework conditions, innovation and technology Transfer;* ENV/EPOC/WPNEP(2009)2/FINAL.

This empirical research by the Organisation for Economic Co-operation and Development (OECD) seems to demonstrate that there is a real cost of not having an ambitious and stable environmental policy. It is not possible to use the OECD results to differentiate on each environmental sector.

Having established the link between an ambitious and stable environmental policy and the level of innovation, the next step is whether the innovation leads to significantly cheaper pollution prevention or abatement solutions.

As indicator for such potential for reduced costs, data on the time trend of the costs of prevention or abatement technologies can be used though there are only examples of price/cost timer series data available. Compliance costs are typically assessed ex-ante so only the few ex-post studies can give some indications.

A study from 2006 has investigated the issue[9]. The empirical evidence shows how most environmental technologies have decreased in price over time due to for example innovations. The study shows that the price decrease is above the average effect of technological progress. The study indicates annual unit cost decreases of 4% to 10% compared to the average macro-economic technological progress of 2%.

This means that there is a very important link between full implementation and innovation and the cost of environmental improvements. Considering that the overall eco-industry is estimated to have an EU27 annual turnover in the excess of 300 billion EUR[10], it is clear that technological improvements are very important. If for example innovation leads to 1% additional decrease in the price of environmental goods and services, the annual saving is 3 billion EUR.

Innovations and economies of scale created by a stable and ambitious environmental policy implementation can lead to more efficient products and thereby a higher turnover, more export and higher employment in the sector. Given that the environmental sector is one of the growing sectors and that it employs also less skilled staff, it is important also for the short-term economic recovery and for the long-term development.

Lack of markets

A specific impact in relation to mainly waste policies regards the markets for recycled materials. For example, the assessment of bio-waste has pointed to the lack of a market for high quality compost as a constraining factor for increasing the level of recycling through composting.

General market impacts

Market distortions

Differences in implementation across the EU can lead to competition distortions and hence, some of the benefits of the internal market are not being real-

[9] IVM (2006); *Ex-post estimates of costs to business of EU environmental legislation;*
[10] ECORYS (2009); *"Study on the Competitiveness of the EU eco-industry"*; report for the Commission DG Enterprise and Industry.

ised. This could be relevant for all industries affected by environmental legislation.

Market distortions will happen if the implementation gaps lead to a lower level of competition in some markets, which then means higher prices on the goods/services and lower quantities than what would have been the case happened with on a more competitive market.

There is not much evidence on such competition distortions. One of the few examples regards specific assessments of the competition aspects in relation to the IPPC Directive (IPPCD). Here the flexibility in the interpretation of the best available technologies (BAT) has led to differences across MSs. It has not been possible to identify any strong link between the differences in compliance costs and competitiveness. This is because countries with high environmental standards are typically wealthier due to their generally high competitiveness. It does not mean that the effect does not matter, only that it is very difficult to empirically document it.

Overall investments

The decision on whether to locate new production facilities or where to expand existing capacities could also be influenced by the overall policy regulation. It is probably only in a few cases that the environmental legislation is the decisive factor. There is limited empirical evidence on the magnitude of this cost element, hence, it will not be further quantified[11].

2.3.4 Spillover effects (costs)

The spillover effects could include many elements; in this study focus has been on the climate change impacts. By using the estimated shortfall of Greenhouse Gas (GHG) emission reductions caused by the implementation gaps, this impact can be estimated.

GHS emissions

Spillover effects in terms of reduced GHG emission will come from in particular the waste and air policy sectors. For the waste, there is a potential for reductions through the full implementation of current policies and the specific policy targets. Further waste prevention would give additional and very significant GHG reductions.

For air pollution and quality policies, there could also be significant spillover effects depending on the choice of policy instruments and measures. For the other environmental areas there is less climate change spillover effects.

The simplest way to value any reduction of GHS emissions as a spillover effect would be to apply the price of CO_2 allowances in the EU ETS system. Cur-

[11] In could be the case with regard to climate change policies as they relate to the energy use which in some industries comprises a significant share of the production costs. See the literature on carbon leakage for discussion of whether this effect exists.

rently, the price is around 14-15 EUR[12], but it has varied between 8 and 25 EUR per tonne.

It could be argued that since the emissions are cumulative, less reduction today means more reduction in the future if a maximum temperature increase should be achieved. From that perspective the "true" costs of not realised reductions today could be much higher than what is indicated by the current CO_2 price.

Other spillover effects

For water and biodiversity/nature there are spillover effects between the two sectors. Better water quality will require measures that are likely to have a biodiversity effect as well. Similarly, more protected areas could be one measure to improve the water quality.

Similar effects can be observed in chemicals and waste policy (recycling). Better quality materials, e.g. free of dangerous chemicals, will result in fewer costs linked to processing the waste for recycling and effectively in higher recycling rates.

2.3.5 Administrative costs to industry

The lack of implementation of environmental legislation in certain Member States could imply different administrative requirements in terms of labelling, monitoring, reporting, notification, permits etc which means that companies that are present in different Member States need to operate different systems at additional costs. It could be particularly relevant for SMEs where such administrative costs could be a barrier for exporting to other Member States.

This cost element has a similar effect as that resulting from not harmonised standards across Member States. Several directives allow for flexible implementation so that such lack of harmonisation could be legally acceptable though it still implies higher overall administrative costs.

There seems to be limited evidence of this effect. Hence, the importance cannot be quantified. Through the initiative on reducing administrative burdens, the administrative burden related to environmental legislation has been estimated at a little more than 1 billion EUR per year. The effect of uneven implementation is not likely to be more than a few percentages so the possible order of magnitude would be a few million EUR per year. Overall the environmental sector only amounts to one percentage of the estimated total administrative burdens[13].

2.3.6 Litigation costs

The litigation cost has been estimated using the number of infringement cases as an indicator. The costs per case can vary so only a very rough assessment is feasible. The main issue with for example infringement cases for Member States authorities relates not to the financial costs, but to the unplanned inter-

[12] Price from Point Carbon 9 February 2011.
[13] COM(2009) 544.

ference in the daily work by drawing key staff away from "normal" work on the implementation of other environmental policies.

2.3.7 Overview of cost elements

The cost elements that this study is looking at are summarised in Table 2-3. For each element the coverage and the indicators applied to support the assessment are listed.

Table 2-3 Cost elements - coverage and indicators

Cost element	Coverage	Indicators
Environmental and health costs	Included by quantitative estimates and for some areas also monetised.	Implementation gaps Monetised values for environmental quality.
Uncertainty, innovation and competition distortions	Included regarding their impact on innovation while market distortions are only qualitatively discussed.	The relation between the stability of environmental policy and patents in "green" technologies are used as an indicator.
Spillover effects	GHS emission included - in most cases quantified.	GHS emissions and CO_2 price (EU ETS-based).
Administrative costs to industry of different standards etc	Different standards exist due to both implementation gaps and lack of harmonization (legally provided for in the directives).	No specific indicator - examples where identified.
Litigation costs	The administrative costs of infringement cases and the EU pilot are included.	Number of cases and cost examples.

3 Findings

This section summarises the analysis of the individual environmental sectors with regard to the implementation gaps and the associated costs. Part two of the report (appendices) includes the detailed assessment of each environmental sector. In this section the analysis is organised around the identified gaps and each of the most important cost elements.

3.1 Implementation gaps

The implementation gaps are described for each environmental sector and by Member States. The overall policy target or objectives within each sector forms the basis for assessing the gaps.

3.1.1 Implementation gaps by environmental sector

Firstly, the indicators and data sources or evidence are described followed by the assessment of each indicator.

Table 10-1presents the indicators and the data sources used to make an assessment of the implementation gaps.

Table 3-1 Indicators and evidence by environmental sector

Environmental sector	Indicator	Data/source	Evidence	Uncertainty
Waste	Waste treatment	Reporting on compliance with the Landfill Directive	Semi-quantitative indications on the share of landfill not compliant	Medium-high
	Waste re-use/recycling/ recovery	Aggregated waste data and data on specific waste streams	Quantitative though data not complete for EU27	Low

Environmental sector	Indicator	Data/source	Evidence	Uncertainty
	Waste shipment	IMPEL inspection projects	Number of illegal waste shipments in two samples of joint inspections	Medium-high
	Waste prevention	Various reports with examples of bio-waste and general waste statistics	Semi-quantitative indications and illustrations of the potential	Low
Nature				
	Loss of biodiversity	Various databases and reports on the status of biodiversity	There is an increasing number of studies assessing the costs of biodiversity loss	Medium/high
Water				
	Good ecological status of freshwater	River Bassin Management Plans (RBMPs) from MS	The RBMPs give some indication of the expected status by 2015	Medium
	Risk of flooding			
	Health protection	Implementation reports on the Drinking Water Directive (DWD) and the Bathing Water Directive (BWD)	There are limited data on the possible health impacts from any case of non-compliance	Medium
Air				
	PM and ozone	Monitoring data and reports	Monitoring data indicate compliance with air quality standards	Low

Environmental sector	Indicator	Data/source	Evidence	Uncertainty
Chemicals	Safe use of chemicals Phasing-out of dangerous chemicals	ECHA (registration, evaluation, authorisation, restrictions); MS inspections (% of compliance) Eurostat (production and consumption of toxic chemicals[14]), EEA, ECHA (evaluation)	Little evidence due to an early stage of implementation Few specific targets so no quantitative evidence	High
	Noise	Noise maps and evaluation studies	Noise exposure can be described - no data on the effect of legislation	High

Table 10-2 presents an overview of the implementation gaps both regarding the gap between the current implementation and current binding targets and the gap between the current implementation and the agreed future targets.

Table 3-2 Implementation gaps by environmental sector

Environmental sector	Indicator	Current gap	Future gap	Uncertainty
Waste	Share of waste on non-compliance sites	Rough estimate - maximum 10% of the landfill waste (some MSs have a higher share)	Target is the same as today - the gap is gradually decreasing as new landfills are established	The estimate is very uncertain as there are no data on the share of waste going to sub-standard sites

14 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Chemicals_management_statistics

Environ-mental sector	Indicator	Current gap	Future gap	Uncertainty
	Share of biode-gradable waste to landfills	Currently 41% of bio-degradable waste on landfills - 14 MS above 50%	The target is tight-ened so the gap in relation to the 2016 target is large - the trend is that more bio-waste is being recycled	Relatively certain estimates
	Recycling of pack-aging waste	All MSs are in compliance. new MSs have time derogations	The current aver-age recycling is 70% - five MSs are below 55%	Relatively certain estimates
	ELV	Most MSs are in compliance though by 2008 three MSs did not reach 2006 reuse/cycling tar-get	Six MSs do al-ready comply with the 2015 target; the rest needs to in-crease their re-use/recycling	Relatively certain estimates
	WEEE	Only 10 MSs are in-compliance with the collection tar-get - high rates of recycling for col-lected waste - but also significant problems with ille-gal export of WEEE.	Significant gap to proposed 2016 tar-get.	Relatively certain estimates
	Batteries and ac-cumulators	Collected batteries are recycled	The aggregated collection rate is around 18% com-pared to the 25% target for 2012. Many MSs need to increase their col-lection.	Relatively certain estimates

Environmental sector	Indicator	Current gap	Future gap	Uncertainty
	Construction and demolition waste	No current target - the collection varies across MSs	Many MSs are below the 2020 target of 70%	Somewhat uncertain - lack of data
	Waste prevention Decoupling between waste generation and GDP or consumption	No specific target - few examples of MSs that have reduced their waste generation (e.g. Germany)	Projections for a slight increase in the total waste generation suggesting an increasing gap	The total current waste generation is relatively well reported
	Waste shipment	Maybe 20% of all shipments are illegal	No new policy targets so the gap depends on whether implementation is improved	Medium (it is well documented that there are may illegal shipments - though the true extent is not known)
Nature				
	The levels of biodiversity: Species abundance; state of natural resources; protected areas; pollution; etc…	There is a continued loss of biodiversity	Projections suggest that the annual loss could increase	There is increasing documentation on the loss; however, the uncertainty is high for some sectors.
Water				
	Freshwater - good ecological status	The current requirements are generally meet - some of the new MSs need additional investments in urban wastewater treatment (UWWT)	The RMBPs suggest that many water bodies will not comply with the target- but the significance is difficult to assess	Medium-high. GES includes a long list of parameter standards to be complied with - not all lead to significant costs if they are not met.

Environ-mental sector	Indicator	Current gap	Future gap	Uncertainty
	Flooding	No current re-quirements	Many MSs need to prepare action plans	
	Health protection	General compli-ance with the DWD and the BWD	No new targets	
Air				
	PM and ozone	The ambient air quality standards are exceeded in many cities	The targets in the National Emis-sions Ceilings Directive (NECD) are projected to decrease the gap	Relatively certain based on monitor-ing data
Others	Chemicals	Limited quantita-tive data	Limited quantita-tive data	High
	Noise	No specific gap as there is no binding target	Large share of population exposed to noise	High

3.1.2 Implementation gaps by Member State

It is difficult to summarise the implementation gaps by Member States.

The number of infringement cases can be used as one indicator for the overall implementation level in each Member State. Based on the data for open cases in 2008 and 2009 (average number of cases over the two years) the following picture can be drawn:

- More than 30 cases (2008 and 2009): Spain, Ireland and Italy
- Between 20 and 30 cases: Belgium, Czech Republic, Greece, France, Por-tugal and the UK
- Between 10 and 20 cases: Austria, Bulgaria, Denmark, Estonia, Hungary, Lithuania, Luxemburg, Malta and Slovakia

- Less than 10 cases: Germany, Finland, Latvia, the Netherlands, Romania, Sweden and Slovenia.

The most recent Member States still have many specific time derogations (Bulgaria and Romania). There is an increase from 2008 to 2009 in the number of infringement cases in these Member States. Other new Member States also have time derogations; thus one could expect the number to increase (some of the new Member States have seen an increase). Using the infringement cases as an indicator of which Member States that have a gap in relation to the implementation of the current policies and compliance with currently binding targets, the new MSs are not as a group different from the old MSs.

The below table summarises the implementation gaps by environmental sector.

Table 3-3 Implementation gaps by MSs and environmental sectors

Environmental sector	
Waste	The new MS generally landfill more waste and recycle less and in several cases they are not meeting the EU minimum recycling targets. Municipal solid waste (MSW) generations are lower in the new MSs compared to the old MSs.
Biodiversity/ nature	Biodiversity loss is ongoing in all MSs. However, the type and rate of decline is context and geographically dependent.
Water	There is no specific difference across MSs with regard to the state of the water quality. Some of the northern and central European MSs have higher levels of wastewater treatment, but also a more intensive agriculture.
Air	There are issues regarding the local air quality in all major European cities - MSs with a higher population density have a higher share of their population exposed.
Chemicals	There are no specific quantitative targets and no indicators to measure compliance.
Noise	There are no specific targets (noise mapping could be compared).

3.2 Costs of not implementing the environmental acquis

The different cost elements identified are defined and described in the below table. The costs vary in nature. Some are related to observable effects and

though there might be uncertainty about their monetary value, they can be considered as well documented. Others are less observable though there is still evidence that supports their importance, and yet other cost elements are more "theoretical effects", for which there is only more anecdotic evidence available.

Table 3-4 Definition of cost elements

Types of costs	Definition of costs element	Evidence and certainty
Environmental and health costs	All not realised environmental and health benefits. These include all values and services provided by all the environmental sectors.	There are reasonable and well documented impacts - the monetisation is subject to uncertainty, but the order of magnitude estimates can be made.
Not realised market benefits in the green industries	Costs related to the eco-industries: • uneven competition • not utilised economics of scale • lack of innovation due to uncertainty and low ambitions	There is limited quantified evidence on the magnitude. The growth of the "green" sector is linked to the increased demand for environmental improvements and the link between innovation and the certainty of the environmental policy is documented.
Uncertainty and market distortions	Uneven implementation lead to different regulatory costs for companies across the EU and affects fair competition.	There is limited hard evidence on this effect. There is anecdotic evidence from companies.
Administrative costs for industry	Different implementation leads to different administrative requirements for companies operating across the EU.	There is no hard evidence on this element.
Litigation costs for MS	There are current infringement cases in relation to the environment acquis.	The costs related to infringement cases could be a few million EUR - the main impact is the disruptive effect on MSs ministries and Competent Authorities (CAs).
Spillover effects	Climate change: The emissions of GHGs constitute an important cost element. Less reduction in GHG emissions now means more reductions later to meet the overall objective of keeping global warming at maximum 2°C. It means that the costs are not a loss but expenditures that will come later.	The not realised reductions in the GHS emissions due to policy implementation gaps are well documented subject to the uncertainty about the actual implementation gap.

Each type of cost is described in the subsequent sections starting with environmental and health costs.

3.2.1 Environmental and health costs

The environmental and health costs are summarised in Table 10-5. The monetised costs of not implementing the environmental acquis are indicated by the likely order of magnitude. The costs related to GHS emissions are presented separately in Section 3.2.5 below.

Table 3-5 Overview of environmental and health costs by sector

Environmental sector	Indicator	Environmental and health costs	Evidence/data	Uncertainty
Waste	Share of waste on dumpsites	Millions of EUR in relation to environmental damages. Possible later clean-up costs - not quantified[15]. Accidents with for example mining waste can be very costly.	COWI 2000 study on external costs.	High is high as both the quantity and the unit costs are uncertain.
	Reuse/recycling	No reuse/recycling means more virgin material to be extracted/ processed meaning large environmental impacts and GHG emissions. Estimates suggest billions of EUR.	Sector studies on lifecycle impacts.	Medium-high - lifecycle environmental cost and benefits are complex leading to uncertainty.
	Waste prevention	Waste prevention reduces environmental and health costs - estimates suggest billions of EUR.	Examples of biowaste and food waste - various European Commission reports and supporting studies.	The potential for prevention is difficult to estimate, while the benefits of prevention are well documented.

[15] If 10% of the MSW are landfilled at sub-standard sites, the total annual environmental damage would be around 400 million EUR per year. If at a later point in time the clean-up of contaminated landfill sites would require 1,000 sites to be clean at just 0.5 to 1 million EUR each, the total costs would be 500-1,000 million EUR; see Appendix A for more details.

Environ-mental sector	Indicator	Environmental and health costs	Evidence/data	Uncertainty
Nature				
	Loss of biodiver-sity	Key environmental costs involve vulnerability and resilience of ecosys-tems and loss of ecosys-tem services. Key health costs relate to disaster prevention, genetic di-versity, diseases, spread-ing of pests, air pollu-tion, etc. There are esti-mates suggesting annual costs of 50 billion EUR (global loss).	EEA reports on state of the envi-ronment; COPI; SOER 2010; plus several sector-specific data sources.	In most cases fairly high as proxies are needed to calcu-late most of the cost elements.
Water				
	Good ecological status	The costs are likely to be in the order of some billions EUR.	Valuations from a few MSs on the Water Frame-work Directive (WFD)	Very uncertain - there are only few studies and the specific link to the compli-ance parameters is weak.
	Flooding	Flooding costs millions of EUR every year - it is unclear how much im-provement the Flooding Directive will achieve	The costs of flooding are well documented.	Medium
	Health protection	Limited costs as compli-ance rates are high.	Monitoring data on DWD and BWD.	Low

Environmental sector	Indicator	Environmental and health costs	Evidence/data	Uncertainty
Air				
	Particulate Matters (PM) and ozone	The monetised health costs amount to 20 to 40 billion EUR per year (costs in relation to the 2020 targets in the Thematic Strategy).	Reports and assessment as part of the NECD revisions AEA and IIASA studies	Medium (some uncertainty on both health effects, i.e. the number of lost life-years and the monetary valuations).
Others	Chemicals	Benefits to human health due to REACH in the range of 50 billion EUR over the next 30 years, using prudent assumptions. Avoided environmental costs (clean-up etc.) described in DHI, 2005.	REACH Extended Impact Assessment[16] DHI, 2005[17]	
	Noise	Annual noise damage in excess of 3 billion EUR - unclear impact of existing policies.	Noise mapping and valuation studies.	Medium-high

3.2.2 Costs related to uncertainty, innovation and market distortions

The costs that affect markets and industries can be divided into the effects on the eco-industries and the effects on all other industries and markets.

The main impacts are on the eco-industries and the markets for environmental goods and services. There are the following main effects:

[16] http://ec.europa.eu/environment/chemicals/reach/background/docs/eia-sec-2003_1171.pdf.

[17] http://ec.europa.eu/environment/chemicals/reach/background/docs/impact_on_environment_report.pdf.

- Implementation gaps lead to a lower demand for environmental services and goods which means that possible economies of scale are not realised due to the low demand and thus a lower total turnover on the markets

- The uneven implementation creates uncertainty about the ambitions and stability of the environmental policy which reduces the level of innovation.

These effects are difficult to establish for each environmental sector. Their existence is supported by two key indicators. One indicator shows how the costs of pollution abatement equipment decrease over time, while the other indicator is the relationship between the certainty of the policy and the number of patents.

Market distortions happen when companies in different Member States face differing legislative costs due the uneven and partial implementation of the environmental acquis. This can affect all markets and industries. Typically, the costs related to waste, water and air emission requirements comprise only a small part of the operation costs and it is therefore difficult to estimate any impacts from such differences. The industry states this as a problem and there can be specific industries and markets where this is a real issue. This kind of market distortions will also happen due to the lack of harmonisation of the implementation.

Table 3-6 Uncertainty, economies of scale and market distortions

Environmental sector	Indicator	Uncertainty and market distortions to industry	Evidence/data	Uncertainty
Waste	Share of waste on dumpsites	Distortion to the extent that the industry in some MSs pays less for waste disposal.	Limited	High
	Recycling	Insufficient recycling affects the markets for recycling equipment and recycled materials. It reduces the overall turnover and potential economies of scale is not realised and less innovation. Potentially there are large costs due to missed business opportunities and innovation.	Several studies point to certainty as important for the development of recycling and markets for recyclables.	Medium-high
	Waste prevention	Waste prevention initiatives are likely to support innovation and thereby the competitiveness of EU industries.	There is limited direct evidence of this impact. The importance of a regulatory framework for innovation is documented.	High
Nature				
	Loss of biodiversity	Overexploitations of natural resources could significantly affect the markets - in particular the fishing industry, agriculture and tourism. Also, Invasive Alien Species (IAS) could impact environmental resources.	Collapse of marine ecosystems, loss of pollinators, damage from IASs, loss of genetic diversity, etc.	Medium to high

Environmental sector	Indicator	Uncertainty and market distortions to industry	Evidence/data	Uncertainty
Water				
	Freshwater - good ecological status	There are no specific costs though there is uncertainty about how implementation affects the market for wastewater treatment equipment.		
Air				
	PM and ozone	There are no specific costs though there is uncertainty about how implementation affects the market for pollution abatement equipment.		
Other	Chemicals	Uncertainty about how chemical legislation can affect industries.	No evidence about the existence of effects.	High
	Noise	No effects		

3.2.3 Litigation costs

There are about 450 open infringement cases (2009) related to environmental legislation and there are Member States with more than 30 open cases. The costs related to each case vary depending on the nature of the case so it is not possible to give a total estimate of the costs related to infringement cases.

Though the total administrative costs in the Member States will amount to several million EUR every year, the main burden is that such cases draw in key experts and policy officers in the relevant ministries and competent authorities. As the cases are not planned and budgeted for, this interrupts the other important implementation work.

The few cases that have resulted in financial penalties show that the fines are increasing and that the MSs can expect fines in the order of millions of EUR.

3.2.4 Administrative costs to industry

No quantification has been made as there are no data to support the assessment.

3.2.5 Spillover effects

The main spillover effect is the not realised GHS emission reductions. Many environmental policies reducing waste, water or air emissions will lead to reduced GHS emissions as well.

The cumulative nature of GHS effects means that in order to keep the global temperature rise below 2°C any not realised reductions now means that higher reductions are required in the future. Due to the increasing marginal costs of emission abatement, the additional future reductions are likely to be more expensive that reductions now.

The following table summarised the key results regarding the costs related to GHS emissions and other spillover effects.

Table 3-7 Overview of spillover effects

Environmental sector	Policy target/Indicator	Spillover effects (GHG emissions)	Evidence/data	Uncertainty
Waste	Waste disposal	There are large GHS emission reductions that are not being realised due to excessive use of landfills.	Various reports and data on waste disposal.	Medium
	Waste recycling	More recycling can reduce GHS emissions through less use of virgin material.	Various reports and data on waste recycling (e.g. Prognos 2008 which includes detailed simulation of possible GHG reductions from full implementation of the waste legislation.	Medium-high

Environmental sector	Policy target/Indicator	Spillover effects (GHG emissions)	Evidence/data	Uncertainty
	Waste prevention	The potential for GHG emission reductions is huge. Preventions mean that all the lifecycle GHG emissions are avoided.	Bio-waste studies and United Nations Environment Programme (UNEP) study.	
Nature				
	Loss of biodiversity	Forests are among the greatest sequesters of carbon. The loss of forests immediately impacts GHG levels.	Assess trends in the spreading and decline of forests and vegetation.	Medium
Water	Good ecological status	Limited spillover.		
	Sound health protection	Climate change adaptation will be linked to water scarcity measures.		
	Prevent flooding	Climate change adaptation will be linked to flooding risk.		
Air				
	PM and ozone	There could be spillover effects from certain measures to improve the air quality.	Sector reports.	The spillover to GHS depends on the types of measures applied to improve the air quality.
Others	Chemicals and noise	Likely spillover effects from chemically safe materials to enhance recycling.		

3.2.6 Overview of costs

The costs are further summarised firstly by types of costs and secondly by environmental area for both current and future policy targets.

Table 3-8 Summary of costs by type of cost

Types of costs	Qualitative description	Quantification/monetisation	Evidence and certainty
Environmental and health costs	In particular environmental and health benefits from air pollution is substantial. Also the loss of biodiversity is significant.	These costs are included in the billions of EUR for EU27.	There are reasonable well documented impacts - the monetisation is subject to uncertainty, but it cannot affect the order of magnitude.
Not realised market benefits in the green industries	The green sector - for example recycling - has a huge potential which is not fully utilised due to uneven implementation.	There is limited quantified evidence - however, only a few percentages of not realised activity in the green sector mean hundred of millions of EUR.	
Uncertainty and market distortions	Uneven implementation leads to different regulatory costs for companies across the EU and affects fair competition.	This impact cannot be quantified.	There is limited hard evidence on this effect. There is anecdotic evidence from companies.
Administrative costs for industry	Different implementation leads to different administrative requirements for companies operating across the EU.	This cost element could amount to a few millions EUR.	There is no hard evidence on this element.
Litigation costs for MSs	There are current infringement cases in relation to the environment acquis.	The costs related to infringement cases could be a few million EUR - the main impact is the disruptive effect on the MSs' ministries and CAs.	

Types of costs	Qualitative description	Quantification/monetisation	Evidence and certainty
Spillover effects	There are significant not realised GHS emission reductions from waste in particular, but also from air and biodiversity.	The not realised GHG emission reductions can be estimated to billions of EUR.	Estimations for the waste sector suggest that up to 250 Mt CO_2 equivalents could be saved through more recycling etc and the value would amount to 3-4 billion EUR per year.

The main cost element is the not realised environmental benefit costs of not implementing the legislation. A summary of the key estimates regarding this element is presented in Table 3-9.

The below estimates are for full compliance with agreed legislation where some targets might be 2015 or 2020. The costs associated with implementation gaps in relation to the targets valid today are less though it is difficult to quantify by how much. The costs can be assessed assuming that for waste about one third relates to the current targets, for water only a small share while for air a larger share (maybe half the costs) and possible over-estimation of biodiversity cost. **As an indicative estimate, the costs of implementation gaps in relation to the current legally binding targets could be around 50 billion EUR per year[18].**

[18] Many Member States have time derogations which make it very complex to estimate the current "legal" implementation gaps. Several of the assessments of the costs of not implementing the existing legislation have a future reference year - for example 2020 as in the case of the waste assessment.

Table 3-9 Costs of not implementing the environmental acquis - future targets in billion EUR per year

	Costs (future targets) billion EUR per year	Comments
Waste	≈ 90	Not realised environmental benefits (including GHG reductions) and value of recycled material
Biodiversity/ nature	≈ 50	Very uncertain - may be an overestimate - indicates an order of magnitude based on the GDP share of the global loss..
Water	≈ 5 - 20	Based on the WTP for a "good ecological state" from a few MSs - the spillover effects on biodiversity and nature are not included. Requirements in the Flooding and Marine Directives might also add to the costs.
Air	≈ 20 - 45	Includes acute health impacts (mortality and morbidity). The limit values for PM, ozone and NO_X are exceeded in zones where 20% - 50% of the EU population lives.
Chemicals (REACH)	≈ 4 - 5	The benefits of REACH based on the assumed share of illness caused by exposure to dangerous substances - uncertain estimate. The long-term effects of the chemical legislation could be much higher.
Noise	≈ 0 - 40	The health impacts of noise exposure - actions plans would not necessarily eliminate all the costs.
Total	**≈ 200- 300**	**An order of magnitude estimate**

Source: See Appendixes for details on each sector

Table 3-10 Cost associated with implementation gaps in relation to current and agreed future policy targets

	Cost		
	Gap in relation to current policy targets	Gap in relation to agreed future policy targets	Trends
Waste	The main costs are in relation to not meeting the recycling targets and the costs in relation to the use of sub-standard landfills (externalities and GHS emissions).	There are costs in relation to recycling levels that should be increased - there are large unrealised benefits of more waste prevention.	The trend is towards more recycling so the gap and the associated costs are not likely to increase.
Biodiversity/ Nature	High costs from continued loss of biodiversity.	The future target is still to halt biodiversity loss. There might be irreversible losses.	A continued loss of biodiversity is foreseen in a business-as-usual scenario.
Water	Some environmental costs due to gaps.	The future targets are significantly more stringent so the costs compared to those targets are more substantial.	The trend is towards a generally improved water quality so the costs could be decreasing.
Air	Environmental and health costs related to exceeding air quality standards.	The future targets require further improvements of the air quality.	There are measures of various trends on reducing emissions from mobile sources that will reduce costs.
Other	No gaps assessed.	No gaps assessed.	No data on trends.

APPENDICES

Detailed environmental sector assessments

Appendix A Waste sector

This section describes the analysis of the waste sector.

A.1. Introduction

The issue

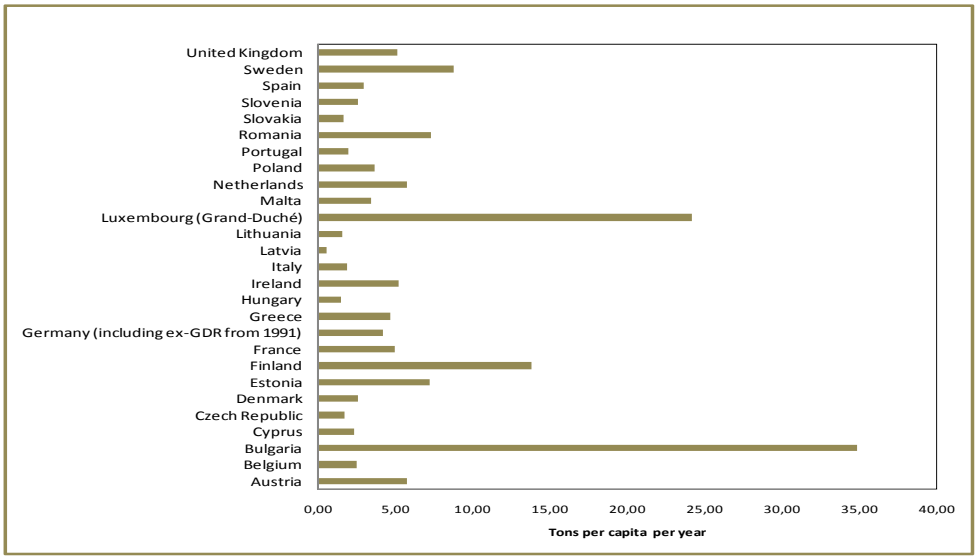
The overall objective of EU's waste policy is the promotion of the waste hierarchy so that waste is first and foremost prevented and higher fractions of the generated waste is reused, recycled or recovered instead on being disposed of.

There are large variations across Member States in how far they come in implementing the EU waste Directives. For specific waste streams, specific targets have been defined and for those the specific level of implementation can be assessed.

The costs of not implementing the waste legislation take many forms. By not using the best and most efficient waste management technologies the environmental damage is higher than it should be. If less waste is re-used or recycled the potential benefits of avoiding the life-cycle impacts of virgin materials are not achieved and similarly if a possible waste prevention potential is not achieved. Then the life-cycle environmental damage of the materials are not avoided and also the costs of producing the materials/products being waste could be been avoided.

The total amount of waste varies between Member States due to for example mining activities in some Member States and mining waste comprise a large share of total waste generated.

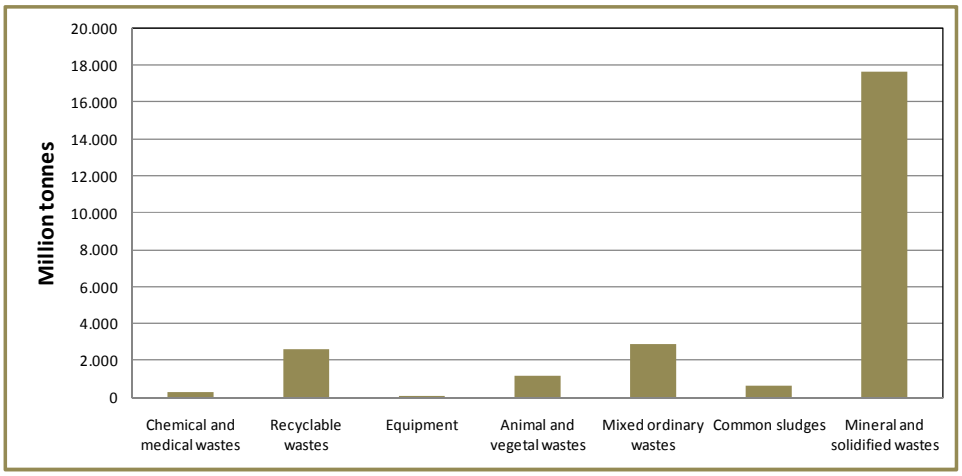
Figure A-1 Total non-hazardous waste generation per capita per year (2008)



Source: Eurostat

The distribution by main types of waste illustrates the significance of mineral waste which include most of mining waste and construction and demolition waste.

Figure A-2 Total non-hazardous waste generation by types of waste (2008)



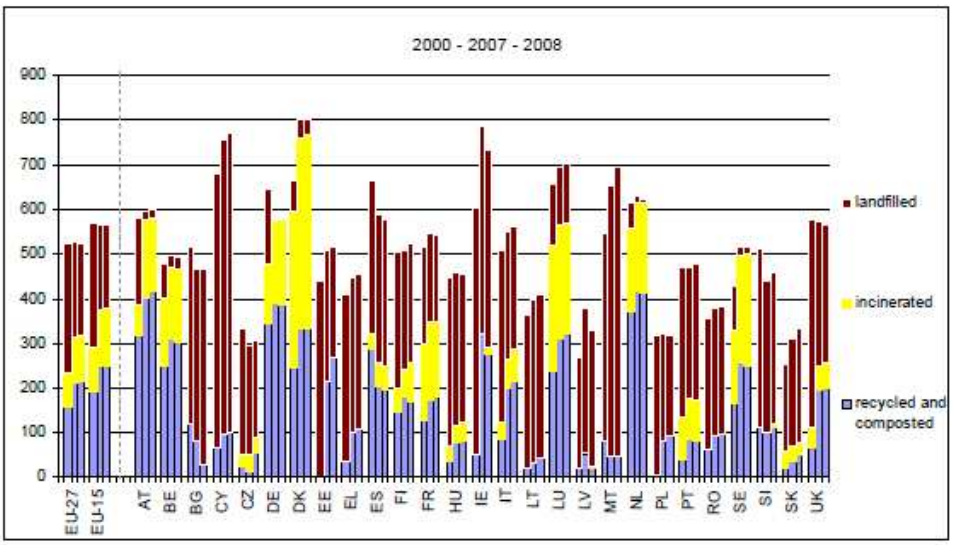
Source: Eurostat

The quantities of municipal solid waste (MSW) generated is more comparable across Member States.

The below figure illustrates the differences across Member States and the development over time from 2000 to 2008. It also shows the differences in waste treatment. The per capita MSW generation varies from around 300 kg per year to 800 kg per year. Also regarding waste treatment Member States have chosen different management systems and landfill comprise from 90% and down to just a few percentage. EU27 average has decreased from 80% to about 60%. The average EU MSW generation per capita has remained more or less constant over the period from 2000 to 2008.

It means that as GDP has increased over the period, the generation of MSW has been decoupled from economic growth.

Figure A-3 MSW generation and treatment in kg per capita per year



Method and delineation

The assessment of the waste sector focuses both on the overall target of waste prevention and on the specific targets for selected waste streams. The targets for the specific waste streams essentially aim also to promote the waste management hierarchy (more re-use, recycling and recovery).

The overall policy targets of more prevention and minimum disposal are not quantified and differences in conditions across Member States also call for some flexibility in the specific implementation of alternative waste management options. LCA analyses of specific waste streams do not always lead to unambiguous conclusion regarding the optimal mix of management options. It is therefore not possible to conclude that more recycling will be in improvement in all situations.

In order to illustrate the costs of not implementing the waste legislation, the analysis focuses on:

- Use of sub-standard landfills
- Use of landfills instead of recycling and recovery (materials recycling and incineration with energy recovery)
- Not meeting the landfill directive targets on diversion of biodegradable waste
- Recycling rates below the target rates for
  - Packaging waste:
  - Construction and demolition waste
  - WEEE
  - ELV
  -

And more qualitative descriptions are provided for:

- Shipment of waste
- Hazardous waste in general
- The specific waste streams (batteries, mining waste, PCBs, POPs and waste oils)
- Waste preventions[19]

A1.1 Compliance gap

The below lists the main Directives, and the table mentions the key quantified targets and elements of each Directive. Further, the table provides considerations as to the types of indicators that can be used to illustrate the compliance gap on an EU level and for each of the EU27 Member States.

[19] Directive and legislation aimed to reduce the use of hazardous substances e.g. REACH and RoHS are covered under the chemical sector.

The table does not consider the following special waste streams for which there are no quantifiable targets:

- Mining waste: No specific targets for recycling etc - reduce risks of accidents
- Hazardous waste: No specific quantitative targets, protection against any release of hazardous substances
- PCBs, POPs: No specific quantitative targets, protection against any release of hazardous substances
- Sewage sludge: No specific quantitative targets, protection against any release of hazardous substances
- Waste oils: No specific quantitative targets, protection against any release of hazardous substances

Based on the below table, graphs and tables will be identified and reproduced in order to provide an overall picture of the compliance levels. Main sources are envisaged to be DG-ENV homepage, relevant impact assessments and other studies, and the Environmental data centre waste which links to Eurostat and to EEA.

Table A-11 Policy targets and associated indicators

Directive	Contents in focus here	Compliance indicators
Waste Directive (2008/98/EC)	Sets out the waste hierarchy: Prevention Preparing for re-use Recycling Other recovery including energy recovery Disposal (banning the disposal of certain waste fractions) Defines End of Waste Criteria	Developments in waste generation relative to GDP Extent to which separate collection is established for paper, metal, plastic and glass (obligation by 2015 and target of 50% by 2020) Construction and demolition (70% recycling target by 2020) Share of waste prepared for re-use and recycling (2020 target of 50% of total weight) Disposal operations undergoes safe disposal operations which meet the provisions of the Directive (See specific targets in below table)
Hazardous waste Directive	No quantitative targets - difficult to assess compliance	Not available
Waste Shipment Regulation	Formally high compliance - cases of illegal shipment could be indicator	High number of Illegal shipments indicates implementation and enforcement issues
Landfill Directive	Lack of compliance regarding landfill standards and fraction of biodegradable waste going to landfill (maximum 35% of biodegradable waste to landfills in 2016). For Member States with more than 80% landfilled in 1995 a time derogation was possible. The following MS has time derogation to 2020: Bulgaria, the Czech Republic, Estonia, Greece, Ireland, Latvia, Lithuania, Poland, Romania, Slovakia and the United Kingdom	Biodegradable waste in landfills (see below table for specific targets) Information on compliance levels of landfill designs in the EU
Incineration directive	Directive sets emission limits - in principle compliance can be quantified - close link to the IPPCD.	Implementation reporting shows that compliance is high - most incineration plants have been permitted and they comply with the air emission limit values
Waste stream legislation	More than 10 waste streams regulated by specific Directives, see below table for specific targets.	

The specific quantitative targets are summarised in the table.

Table A-12 Targets included in current waste legislation

	Year	Collection targets	Recovery targets	Recycling targets
End-of-Life Vehicles	2006	100%	85%	80% including reuse
	2015	100%	95%	85% including reuse
	2005		Vehicles to be recoverable to a minimum of 95 %	Vehicles be reusable and/or recyclable to a minimum of 85 %
WEEE	2006	Min. 4kg per inhabitant per year	70-80% depending on category of WEEE	50-80% including reuse, depending on category of WEEE
	2016 *(proposed)*	*65% of what is set on the market or 85% of waste arising*		
Packaging waste	2008		60%	55% of which 50% metal, 60% glass, paper/cardboard, 22,5% plastics, 15% wood
Batteries and accumulators	2009			100% of collected batteries
	2011			65% for lead-acid batteries; 75% nickel-cadmium and 50% for others
	2012	25%		
	2016	45%		
Paper, metal, plastic and glass waste from households, other household waste and similar waste	2015	Separate collection for at least paper, metal, plastics and glass		
	2020			50%
Construction and Demolition	2020		70% by weight of non-hazardous waste to be prepared for re-use, recycled or recovered	
Biodegradable municipal waste	2006 or 2010 (*)	Reduction to 75% of 1995 landfill levels		
	2009 or 2013(*)	Reduction to 50% of 1995 landfill levels		
	2016 or 2020 (*)	Reduction to 35% of 1995 landfill levels		
Tyres	2006		Zero landfill	

Source: COM 2011[20]

[20] Commission Staff Working Document Accompanying the Communication on the Thematic Strategy on the Prevention and Recycling of Waste

Based on various data sources - notable the recent review of the Thematic Strategy on the Prevention and Recycling of Waste - the compliance with each of the targets are discussed.

In addition to the specific targets the compliance with the landfill Directive is also used as indicator as is the question of waste prevention.

A.2. Gaps and costs of non-compliance

A2.1 Landfill compliance

Gap assessment

There are few data about the amounts of waste that are landfilled at sites that do not comply with the requirements. There are two types of non-compliant landfill. One is illegal dumpsites and the other type is landfills that are authorised or registered in some way based on (previous) national legislation but do not yet fully comply with the directive requirements.

The extent of the use of illegal dumpsites is not known. A study from 2007 looked at the situation in the new Member States[21]. It concluded that new Member States were all in process of closing old landfill sites and concentrating waste disposal at fewer large compliant sites. The total number of old sites was not known or if there were an inventory of closed sites, it was not clear whether some of these old sites were still used to illegally dumping.

From the recent implementation report, data on the number of landfill that are in compliance can be found. These indications are not very detailed and the share of non-compliant landfills might be much higher than the share of waste being dumped at non-compliant sites as the number of non-compliant landfills includes many closed sites.

They could be used as an indicator the share of waste being disposed at below standard landfill/dump sites. It should be noted that waste disposed on illegal dumpsites in most cases results in higher environmental damage than existing sub-standard landfills.

The data are not very detailed and the number of landfills that are not in compliance does not say how much of the waste that is being deposited on these landfills. Based on these data a rough indication is that 15% of the waste is placed on non-compliant sites[22].

Environmental costs

The environmental benefits are related release of methane gas, leachate and missing pollution displacement that take place in case the landfill gas is flared without recovery of energy. A study from 2000 includes estimate of the

[21] COWI (2007); *"Follow-up study on the implementation of Directive 1999/31/EC on the landfill of waste in EU-25"*; Report for the Commission; Final Report June 2007

[22] Ecologic 2009; *A Report on the Implementation of Directive 1999/31/EC on the Landfill of Waste*

monetised value of the environmental costs from not compliance landfills[23]. Using these results provides and indication of the environmental costs. The 2000 study indicates a value around 15 EUR per tonne of waste landfilled in the non-compliance landfill compared to the compliant landfill. If it is assumed that 15% of the waste goes to non-compliant landfills, the total annual environmental costs would be in the order of 500 million EUR per year.

If waste is placed at non-compliance landfill it might be necessary to later to contain the waste. If it has been deposited for longer time, clean-up of the site might be required.

An estimate of the possible cost of containment has been made in Bio Intelligence Service 2011[24]. It is there assumed that 50% of the MSW waste deposited at landfill require containment. This assumption seems to indicate a very high share of waste not being placed in compliant landfills. The above discussion suggests that overall level of MSW at non-compliance landfills could be around 15%. The estimated containment costs are 15 billion EUR related to 50% of the MSW so if only 15% of the waste is currently placed at non-compliant landfill or at dump sites, the annual containment costs would be 4-5 billion EUR.

Clean-up costs of landfill site where the soil has been contaminated can be substantial.

Economic costs

The economic costs of not implementing the requirements for landfills relate to containment of the waste or the risk of having later to clean up a landfill. These costs could be very high. The example of the containment costs suggests an order of magnitude of 4-5 billion EUR per year.

Clean-up costs for a contaminated site can be substantial.

If waste is not contained and the site is contaminated there could be pollution of water bodies that would impact on the drinking water supply.

Social costs

Part of the social/environmental costs includes health impacts of the pollution from low standard landfills. Additionally, there could be an amenity effect of living close to non-compliance landfill or dump site.

There are several examples of issues with non-compliance waste disposal and the EU Commission has initiated infringement proceedings in several cases. In addition to the below example from Ireland, the Italian case of the Naples waste crises is famous.

[23] COWI (2000); *A Study on the Economic Valuation of Environmental Externalities from Landfill Disposal and Incineration of Waste*

[24] Bio Intelligence Service 2011, "Implementing EU waste legislation for green growth".

Illegal dumping of waste in Ireland
In period 2002 to 2004 there seems to have illegal expert of 250,000 tons of waste from the Republic of Ireland to Northern Ireland. It is believed that introduction of fee for waste disposal that was one of the main factors that caused the export.
To contain the waste, the Irish Government faces expenses in the order of 36 million EUR.
The European Commission has launched an infringement case which as prompted the Irish Government to take on the "repatriation" of the waste in the light of facing fines if convicted at the European Court.

Overall, waste management implementation and enforcement was radically changed in 1998 with new programme "Change our ways". It included also fiscal instruments such as landfill charges. Part of the reason for illegal waste export and dumping is seen to the increase in the landfill charge. In that respect this is also an example of the complexity of enforcement and that use of economic incentives needs to be carefully implemented

A.2.2 Biodegradable waste: max 35% to landfills by 2016

Gap assessment

The Commission has recently published a communication on the management of bio-waste[25]. It concludes that there are significantly benefits from diverting more bio-waste away from landfills also beyond the 2016. Though the existing legislation specific sets a target for the maximum level of bio-degradable waste that can be put on landfills, the overall objective of the waste legislation is to move waste up in the waste management hierarchy if it can not be prevented. There are also Member States that already today have reduced the amounts on landfills much further.

Data for 2008 suggest an overall rate of 40% on landfills; however several Member States are well above that rate. 15 Member States are below the 2016 target for recycling of biodegradable waste. So it is a substantial amount of biodegradable waste that needs to be diverted away from landfill in order to fully implement the 2016 target In terms of formal compliance with the targets, it should be noted that several Member States have time derogations - up to four years. This does not change the fact that there substantial costs as long as biodegradable waste continues to be landfilled.

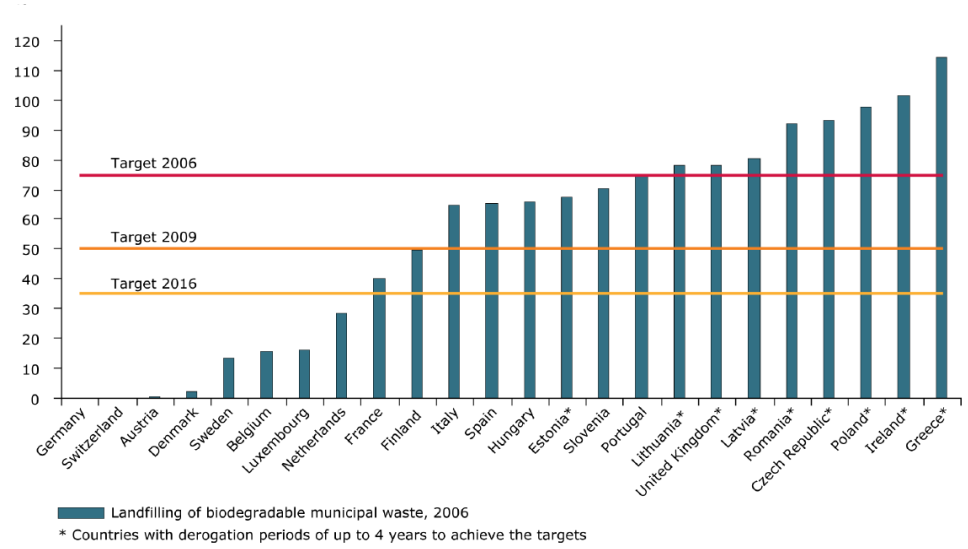
The illustration in Figure 4-4 shows the share of biodegradable MSW being landfilled in 2006 in percentages of the generation of biodegradable MSW in 1995 (basis for the recycling targets).

Most Member States had achieved the 2006 target but for the subsequent targets there a way to go. There is no data to establish the current level though it is likely to have improved. It should be noted that due to the time derogations, most Member States will be formally in compliance.

In terms of assessing the costs of not achieving a higher recycling rates the

[25] COM(2010)235 final

Figure A-4 Landfilled biodegradable MSW in 2006 in % of 1995 waste generation and targets for recycling



Source: COM 2011a (referred to EEA as original source)

Though it is not possible to determine the specific compliance with the 2009 target, the fact that several Member States have derogations, the differences in to the compliance level will not be large. Irrespectively of the legal status, there are environmental costs of not implementing as long as any Member States as above the 2016 target. It is roughly around 20% of the bio-degradable waste in 2006 that should be recycled for all Member States to be below 35% landfill.

Environmental costs

The 2010 Communication on bio-waste has identifying the avoided GHS emissions as the main environmental benefits of reducing landfill of bio-waste.

Additional benefits are production of compost to improve soil quality and increase resource efficiency and production of bio-gas to increase self-sufficiency of energy. Further long term benefits can be achieved via saving of phosphorous, which at global level is becoming a limited resource/raw material.

Though there may not be an implementation gap in relation to 2009 target given the derogations, there is still a environmental costs of not reducing the landfill of biodegradable waste. The monetary values of the GHS emissions and other costs are included in the assessments of the potential for GHG emission reductions, see Section 4.3 and 4.4.

Economic costs

There could be economic gains from the creation of larger market for quality compost if this allows agriculture to substitute more expensive means of soil improvement. Additional prevention of bio-waste will lead to significant savings for the households as they save both in direct expenditure on food and the waste treatment costs; see Section 4.2.11 for an example of the savings from prevention of biodegradable waste.

Social impacts

There could be additional job associated with implanting the bio-waste requirements for example in relation to the treatment facilities.

A.2.3 Recycling of paper, metal, plastic and glass

Gap assessment

The target is 50% by weight by 2020 for at least paper, metal, plastic and glass from the municipal waste stream. There seems to be limited data specifically recycling of these materials from the municipal solid waste.

The packaging fractions of materials are considered in the next section.

Costs

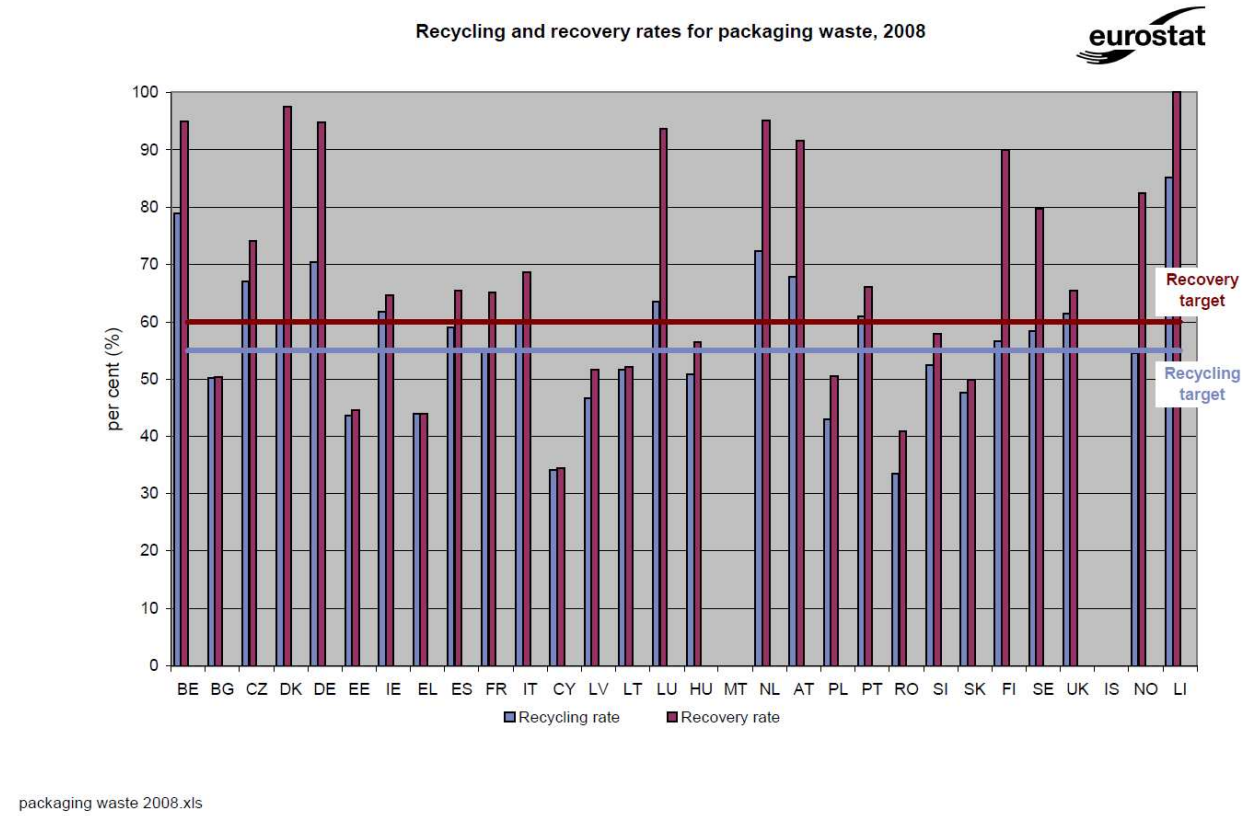
The challenge with these specific types of wastes is what the benefits or recycling specifically based on a lifecycle approach. There is a resource efficiency effect but where in all cases the total emissions from the collection, sorting, and recycling process are lower than those from use of virgin material is more complex to determine.

A.2.4 Recycling of packaging waste

Gap assessment

There are several targets for recycling of packaging waste, the overall recycling target is 55% by 2008 (some Member States have time derogations) and then specific targets for glass (60%), paper (60%), cardboard (60%), metals (50%), plastic (22,5%) and wood (15%).

Figure A-5 Recovery and recycling rates for packaging waste in 2008



Source: COM 2011a (there referred to as Eurostat Waste Data Centre 2010)

Table A-13 Recycling rates for glass 1999 to 2009 in %

Countries:	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Recycling rate %	%	%	%	%	%	%	%	%	%	%	%
Austria	84	84	83	87	86	88	83	84	80	84	90
Belgium	80	87	88	95	88	90	92	91	92	96	96
Bulgaria								33	32	23	27
Cyprus										10	18
Czech Republic								55	50	62	73
Denmark	63	65	65	76	71	75	70	75	84	88	88
Estonia								32	47	32	46
Finland	78	89	91	92	73	72	72	72	61	92	80
France	55	55	55	55	58	58	57	60	61	61	63
Germany	81	83	87	90	88	91	86	89	82	82	81
Greece	25	26	27	27	30	24	17	10	13	12	15
Hungary								18	20	24	23
Ireland	35	35	40	49	67	69	81	81	73	80	76
Italy	41	40	55	52	59	61	62	59	60	72	77
Latvia										35	53
Lithuania										36	50
Luxembourg										75	74
Netherlands	91	78	78	78	81	76	78	77	81	81	92
Poland							33	28	26	36	44
Portugal	42	40	34	35	38	39	41	46	46	52	56
Romania								9	9	11	22
Slovakia								35	34	38	34
Slovenia											80
Spain	40	31	33	36	38	41	45	51	56	60	67
Sweden	84	86	84	87	92	96	96	92	94	94	90
United Kingdom	26	29	34	34	36	44	53	50	57	61	62
TOTAL EU	56	54	58	60	60	63	64	64	62	65	67
Croatia											51
Norway	83	85	88	88	86	90	90	90	99	92	89
Switzerland	93	91	92	94	96	96	95	96	95	95	95
Turkey	25	24	24	23	22	24	24	22	19	19	25
TOTAL EUROPE	56	55	58	60	60	63	63	64	62	64	67
Ukraine											30

[1] Data from Malta are not available

Collected cullet:
Non-factory cullet from used returnable and non-returnable glass containers (whatever the source: skips, kerbside collection, bottlers, restaurants, hotels, etc.) collected in the country concerned, the fact that it may subsequently have been exported being of no con sequence.

National consumption of glass containers:
National production of all glass containers (including returnable glass containers), plus imports (unfilled and filled), minus exports (unfilled and filled).

Calculation formula:
National tonnage of cullet collected (tonnes) x 100 = ...national recycling rate (%)
National glass consumption (in tonnes)

Source: FEVE Data sheet: Glass collection for recycling - 10 years historical background 2009

The overall status on recovery and recycling in the Member States is illustrated in Figure 4-5. Overall Member States are in compliance or have time derogations.

The data shows that most Member States recycle at least 55% of the packaging waste (measured by weight) and at aggregated figure for EU27 is about 70%.

Data on selected packaging materials show that for glass the aggregated EU27 recycling is 67% while individual Member States are below the 60% target. It is mainly the new Member States which have time derogations.

Costs

Further recycling or at least energy recovery will save energy and materials so the main costs of implementation gaps are the not realised benefits of increased recycling or recovery. The specific cost estimates are include in the overall assessment in Section 4.3 on GHS emission and 4.4 on total costs of not implemented waste legislation. .

A.2.5 Recycling of construction and demolition waste

Gaps assessment

For construction and demolition (C&D) waste the target is 70% recycling by 2020. Data on the generation of C&D waste is relatively uncertain and there is large variation across Member States. It is possible to achieve the 70% target which is already surpassed in several Member States. C&D waste should be recycled locally, as transport will add to environmental and economic costs as C&D are relatively low value per tonne.

Costs

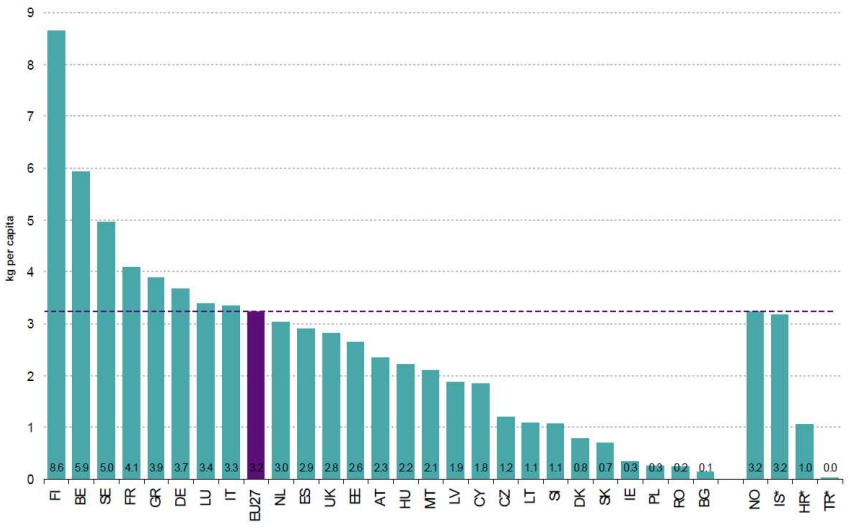
The overall costs in terms of not realised environmental benefits are relatively small for this fraction. The value as recycled material is relatively low and there is not a large GHS emission avoidance potential.

In the overall assessments, the C&D waste stream is included, see Section 4.3 and 4.4.

A.2.6 Recycling of batteries and accumulators

Gap assessment

For batteries and accumulators there are specific recycling targets in addition to the general requirement that these products containing hazardous materials should not enter the MSW stream.



Source: COM 2011a (there referred to as Eurostat Waste Data Centre 2010)

The figure shows that the collected amount varies across Member States and although the amount of batteries and accumulators on the markets also vary some Member States have to increase collection to achieve the 25% collection target for 2012.

The collected batteries are generally recycled so the main challenge is to increase collection.

Costs

There are valuable metals that can be recovered and thus, the higher the recycle rate the better. The environmental costs include the saved energy and GHS from use of virgin raw materials instead of recycled material. Also the risk of hazardous substances entering the environmental means high costs if the collection rate is low.

A.2.7 End-of-life vehicles

Gap assessment

The targets for recycling of vehicles are to reuse or recover (including energy recovery) 85% increasing to 95 by 2015 and it is to reuse or recycle 80% increasing to 85% by 2015. In most Member States these targets have been achieved.

Costs

Given the high value of the secondary material content it is likely that most vehicles will be recycled in one way or another. Issues such as pollution with hazardous substance could occur if recycling takes place at not licensed facilities.

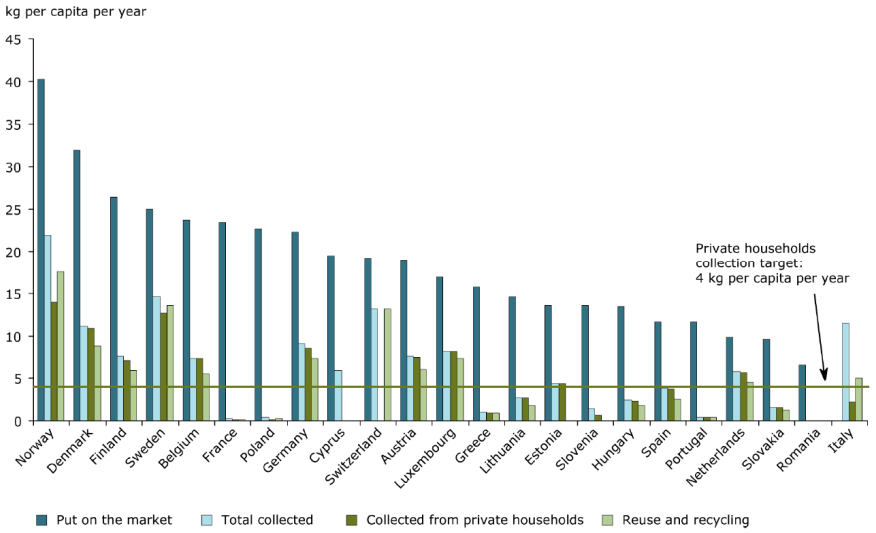
A.2.8 WEEE

Gap assessment

There is a target for the collection of electric and electronic equipment. This target is 4 kg per person per year. The below figure illustrates the amount put

on the market and how much is collected. For many Member States a large amount of WEEE is not properly collected and treated. There is a proposal for collection target of 85% of amount put on the market by 2016 and to achieve that additional efforts are required for almost all Member States.

Figure A-6 WEEE placed on the market, collected and reused/recycled in kg. per capita for 2006



Source: EEA 2010, The European Environment, State and Outlook 2010 : Thematic Assessment – Material Resources and Waste

For the Member States where there are data on both collection and reuse/recycling, the reuse/recycling rates seem fairly high - estimated to around 79%.

Costs

WEEE contains both materials that can be recycled and hazardous materials that should not enter the environment. Hence, the environmental costs of associated with implementation gaps can be substantial. In relation to WEEE it should be mentioned that a lot of the examples of illegal waste exports violating the Waste Shipment legislation concern WEEE being exported to developing countries where it is being "recycled" under very poor conditions regarding workers protection and environmental impacts.

A.2.9 Other waste streams

For most of the other waste streams, there are no specific recycling targets. They are often hazardous materials where the environment benefit of proper waste management is in prevention of pollution with dangerous substances.

- Mining waste: No specific targets for recycling etc - reduce risks
- Hazardous waste: No specific quantitative targets, protection against any release of hazardous substances

- PCBs, POPs: No specific quantitative targets, protection against any release of hazardous substances
- Sewage sludge: No specific quantitative targets, protection against any release of hazardous substances
- Waste oils: No specific quantitative targets, protection against any release of hazardous substances

For these waste streams there are generally not enough data to undertake more detailed analysis of the implementation of the legislation.

Prevention of hazardous waste and dangerous substances being released is also covered by specific waste stream legislation. For example the WEEE and RoHS Directives are aimed to restrict the use of dangerous substances and make sure that this waste stream is treated in way that prevents release of the dangerous substances. REACH is another important general legislation that should prevent or reduce the use (and thereby the potential release) of dangerous substances into the environment.

If hazardous waste is not collected and treated properly, there is the risk of pollution leading to health and environmental damage. There is also the potential future clean-up cost of sites where hazardous substances have been illegally disposed off.

The toxicity of many substances means that the health and environmental damage could be significant. Often properties such as persistence and bio-accumulative means that once released the substance will continue to do harm.

As part of the assessment of the chemical sector an estimate of potential benefit of REACH is includes which indicate the order of magnitude of the costs of not restricting and reducing the use of dangerous substances.

Another example is mining waste, where the quantities are substantial. There have been several mining accidents which have had substantial costs. These incidents clearly demonstrate the need for proper hazard potential based protection measures to be implemented.

A.2.10 Shipment of waste

The issue

There is regulation on shipment of waste which generally defined the principles of waste shipments and regarding shipment of hazardous waste the regulation is an implementation of the Basel Convention.

The regulation aims to protect the environmental by preventing uncontrolled shipments of waste which would result in the waste not being treated or disposed in an environmental sound way. The main provisions include:

- Notification procedure for waste shipments

- Restrict shipment of hazardous waste outside of the EU

The restrictions on export are particular important as both treatment and disposal of waste can be done at lower direct financial costs in countries with no waste regulation at the expense of environmental and health damages.

Gap assessment

The officially reported cases of illegal shipments cover only part of the issue but the extent of total amounts of waste being shipped illegally is not known. The data on which Member States that report illegal shipments shows that only certain Member States have reported such cases and it seems unlikely that there are countries with no such cases. This lack of reported cases points to gaps in the effectiveness of inspections when no cases are found and reported.

IMPEL has undertaken several projects about illegal waste shipment and they have included inspection activities. In the most recent project (IMPEL-TFS Enforcement Actions II) almost 2000 transfrontier shipment of waste was inspected between October 2008 and April 2009. It was found that 19% of the shipments were illegal. This included:

- 37% were illegal transports, mostly ELV's and WEEE to Africa and contaminated/poorly sorted paper-cardboard and plastics to Asia;
- 46% were classified as administrative violation due to missing/incomplete article 18 information;
- 17% were other violations such as missing registration (in national register) as waste transporter/broker, lack of pre-notification of competent authorities or use of a wrong format[26].

Though it is noted that the inspections were target and therefore not represent the average compliance level across EU, the results of this project shows that illegal shipment constitutes a serious problem. Previous projects of the similar kind by IMPEL have shown the same level of illegal shipments.

[26] IMPEL 2009; *IMPEL-TFS ENFORCEMENT ACTIONS II Enforcement of EU Waste Shipment Regulation "Learning by doing"*; Interim report, October 2009 (page 66)

Text box A-1 Illegal waste shipment

Illegal waste shipment

There are many examples of illegal waste shipments. This includes situations where WEEE has been exported to for example Africa under claim of being export of second hand equipment for reuse[1]. The costs of the illegal waste export fall on the worker - often children - exposed to dangerous substances in very poor working conditions and the local environment.

In the UK, the Environment Agency has increased its effort to control the illegal export of e-waste. A national unit to investigate the export was set-up in 2008 and has had success in stopping export and in investigating and prosecuting companies that undertake the activity. Increased inspection activities have included[2]:

- 166 unannounced inspections in first half of 2009 compared to 72 in 2008o
- 132 port check in the first half of 2009 compared to 44 in 2008
- 616 transport checks in first half of 2009 compared to 194 in 2008
- Stop notice on 53 containers in first half of 2009 compared to 40 in 2008.

This is an example of how additional enforcement can improve the situation.

Notes:
1) (e.g. http://www.greenpeace.org/international/en/news/features/poisoning-the-poor-electroni/)
2) Environment Agency: http://www.environment-agency.gov.uk/news/112943.aspx

Cost of illegal shipments

The impact of illegal shipment of waste is both environmental costs typically outside EU and economic costs within EU.

- Environmental and health damages in import country if processing, recycling and disposal facilities are inadequate.
- Loss of income for EU recycling facilities
- Uneven playing field among companies that treat waste according to the legislation and those who illegally export waste.

There are significant environmental and health impacts from inadequate recovery activities. Many of these costs occur in the non-EU countries where the waste is illegally exported.

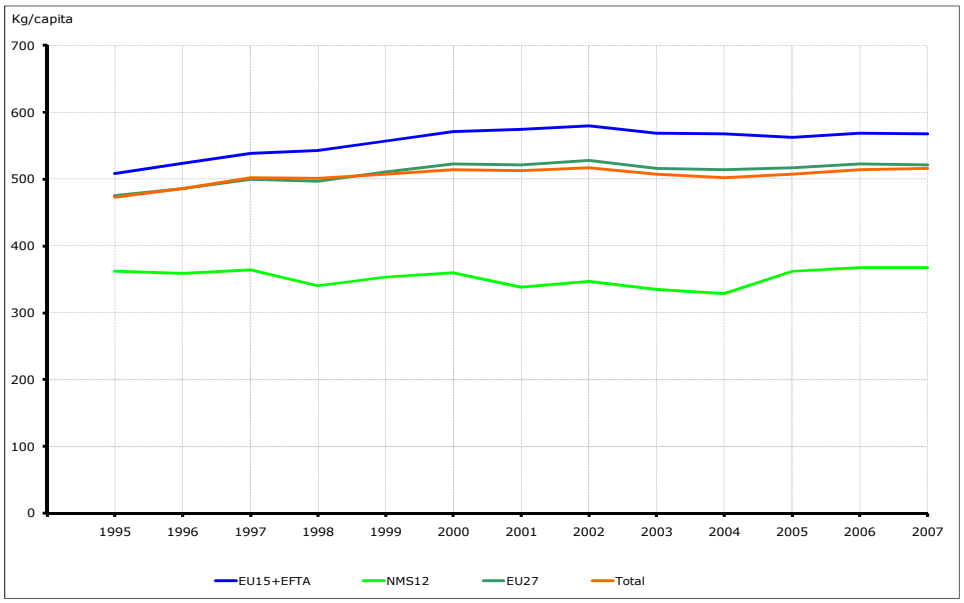
A.2.11 Overall target of prevention, re-use and recycling

The main policy targets relate to the waste management hierarchy where the overall objective is prevent as much as possible and dispose as little as possible at landfill. For some of the specific waste streams discussed above there have been considerations of how to promote prevention of the waste being generated. These examples will be used to illustrate the significant environmental benefits of more waste prevention.

Illustrative MSW example

For MSW, as one of the main waste streams, the following illustrates how the potential for waste prevention could be addressed.

Figure A-7 Development in the generation of MSW per capita

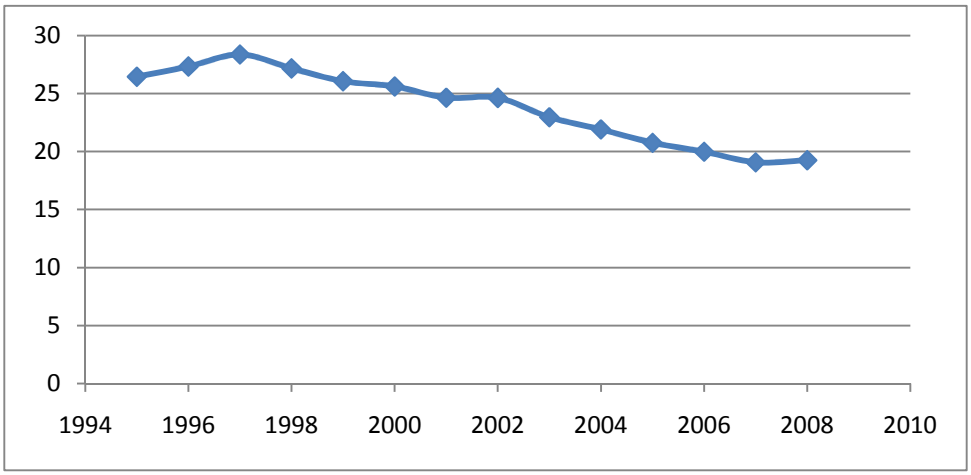


Source: Eurostat

The fact that decoupling of waste generation from GDP has not so far been achieved makes it difficult to estimate a specific implementation gap. The generation of MSW seems to be stabilising and a few Member States - notable Germany - seems to have achieved a decoupling of the MSW generation.

The figure below shows the MSW waste generation per capita per GDP. Over the period 1997 to 2008 the generation has decreased by more than 20%.

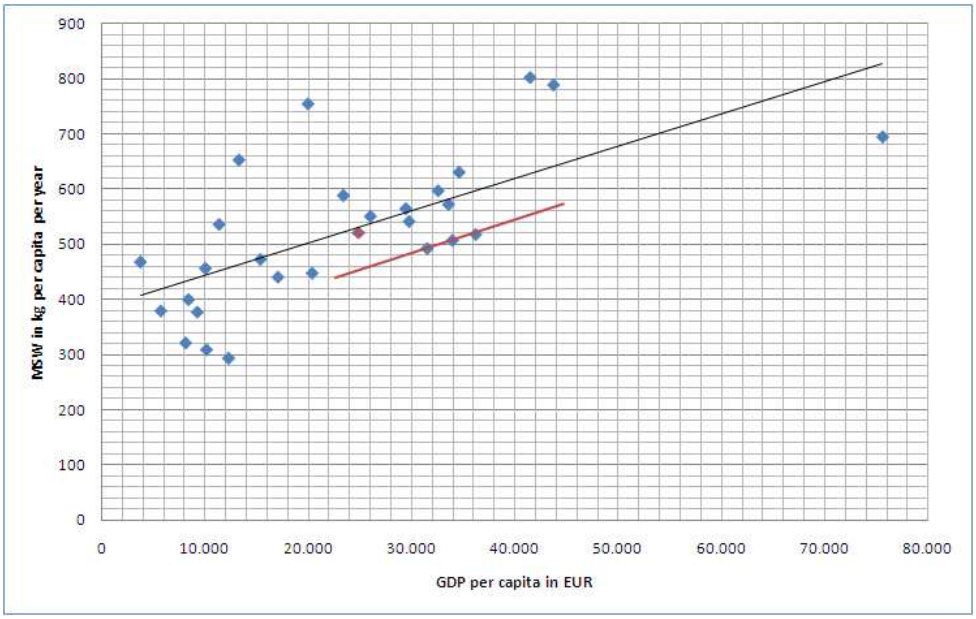
Figure A-8 MSW generation in kg per 1000 EUR GPD per capita



Source: Eurostat and own calculation

The following figure illustrates the relationship between generation of MSW per capita and GDP per capita across EU 27. The average EU values are marked with red.

Figure A-9 Relationship between GDP and MSW generation



Source: Consultants estimate based on Eurostat data

Member States have not achieved the aspirations of the EU waste policy and the missing benefits can be illustrated by looking at the total costs including the environmental externality of the waste generation.

One approach to make an estimate of the potential for prevention of MSW would be to compare waste amounts across Member States and compare the average amount with those with the lowest amounts. Those Member States with the lowest per GDP waste generation would then be used as an indicator for the potential for waste prevention.

Assuming that the three MS included in the red line below the trend line indicate a benchmark for the relationship between MSW generation per capita and GDP, the EU average of 520 kg per capita would be reduced to about 450 kg per capita. This is equivalent to a decrease of 15%.

The example presented below of food waste indicates a saving potential of the same magnitude - around 70 kg per person. To illustrate the potential benefits of such a reduction, we assume that the data from UK study below can be used to generalise a saving potential.

Not all Member States will have the same potential as the UK and other northern European Member States. The illustrative example is based on a prevention potential for only Member States above the average MSW generation of 520 kg per capita.

All the calculation assumptions and the results are displayed in Table A-4.

Table A-14 MSW prevention scenario

	Amounts	Unit
Average MSW	521	kg/capita
Savings	75	kg/capita
Relevant pop	350	million inhabitants
Total savings	26	million tons
GHG per tons	2	CO2 equiv. per tons waste
GHS savings	52.5	million tons CO2 equiv
Collection	20	EUR/tons waste
Treatment	50	EUR/tons waste
Product value	3500	EUR/tons waste
Carbon price	15	EUR/tons CO2 equiv
Savings (collection and treatment of waste)	1,838	million EUR
Savings (value of food products)	90,000	million EUR
Savings (GHG emissions)	788	million EUR

Source: Eurostat, WRAP (2008), Prognos et al (2008) and own calculations

The environmental damages from the prevented waste are not included. There is significant pollution from agriculture, but there no available externality costs to assess the magnitude. The environmental damages apart from the GHS are also not included. The COWI 2001 study on externalities from landfill and incineration suggested total external costs in the order of -9 to 70 EUR/tons. As the prevented waste would have been treated at various technologies including composting it is difficult to estimate an average external cost. At for example 10 EUR per tonnes the saved environmental costs would be around 270 million EUR.

This illustrative example indicates the significant costs associated with not preventing more MSW from being generated. The figure estimated here are the gross benefits of waste prevention, but even though they can not be realised without additional efforts, the potential is so large that there will be significant net benefits.

The example also shows that if waste is prevented part of the saving is the reduced financial costs of purchasing the goods or materials that are no longer being wasted. In the case of food waste this is a significant amount.

Example of bio-waste prevention

There is a more specific example of the benefits of prevention of waste. For bio-waste, a number of options for both preventing the generation of waste and further diversion away from landfill deposition have been assessed.

A large amount of bio-waste is simply due to the fact that households throw away large quantities of food.

Text box A-2 Food waste prevention initiative[27]

A study from the UK has estimated the amount of food that is being wasted. It is a very detailed assessment of the generation of food waste. Key findings are:

- One-third of the total purchased amount of food is wasted
- 60% of the food waste is "avoidable"
- Approximately 70 kg of avoidable food waste per person per year
- Value of the waste food is around 3500 EUR per tons or
- 250 EUR per person per year

The study is very comprehensive in its assessment of a representative sample of respondents including detailed measurement of the generated food waste. The findings from the study have been followed by various initiatives to reduce waste through both a consumer campaigns and a programme with retailers.

Data from the Nordic countries confirm the level of 60-70 kg of avoidably food waste per person per year.

The 2010 communication in the "Future steps in bio-waste management includes option for waste prevention[28].

The preferred option could reduce the amount of waste by around 7.5% in 2020 compared to the baseline projection. This is equivalent to around 14 kg per capita per year. That would lead to significant benefits. The net present value of the monetised benefits are in the order of 4-5 billion EUR for the period 2013 to 2020. These values do not include the financial savings to households from not wasting food and as the illustrative example indicates, the potential financial benefits to the households are huge.

Re-use

As briefly described assessment of the Thematic Strategy on prevention and recycling of waste, it difficult to assess the extent of re-use. There are second hand markets for many products so as long at they are on those markets they

[27] WRAP (2008) *The food we waste*

[28] COM(2010)235 final and SEC(2010) 577 final; *On future steps in bio-waste management in the European Union*

are not classified as waste. Increasing the lifetime of products will lead to less waste being generated.

Recycling

The benefits of more recycling can be assessed though there many complexities. Certain aspects such as the impacts on GHG emission are described in the next section on spill over effects. In the section on Findings, an example is presented with additional saved environmental costs included.

A.3. Spillover effects

In relation to waste, one of the main spillover effects is to the climate change policies. More recycling and more waste prevention will significantly reduce the GHG emissions from the waste sector.

The relationship between waste management and GHG emissions is rather complex. The waste management process of collection, treatment and disposal all emits GHG. Then some options with energy recovery replace other energy sources and thereby potentially reduced overall GHG emissions. Similarly with material recovery where virgin material might be replaced by the recycled material avoiding all the lifecycle GHG emissions. Finally, waste prevention is potentially a very important measure to reduce GHG emissions as recent UN report documents[29]. Waste prevention avoids all the lifecycle GHG emissions from the waste materials as well as the waste management emissions.

Based on the IPCC the current emissions from the waste sector in EU27 are around 150 million tons CO_2 equivalents. The emissions have decreased from a level of about 200 Mt CO_2 eq. in 1990 and they accounted for 2.6% of the total EU27 GHG emissions in 2007.

A projection of the GHS emissions from MSW management illustrates reductions potential from implementation of the current waste policy.

The study has estimated the emission to decrease from 35 million tons CO_2 equivalents in 2005 to about 8 million in 2020. It is an assessment for MSW based on specific approach to estimating and projecting the direct and indirect GHG emissions and therefore is not directly comparable with the emission as reported according to the IPCC principles.

A more comprehensive assessment including most waste streams were undertaken in 2008 by Prognos et al[30]. Their study as estimated the reduction in CO_2 emissions that were achieved in 2004 based on shares of recycling, incineration and landfill at time. Then future scenarios including one with all existing waste legislation have been assessed and the further CO_2 reduction potential has been estimated.

[29] UNEP 2010, *"Waste and Climate Change: Global trends and strategy framework"*

[30] Prognos et al (2008); Prognos et al, 2008, Resource savings and CO2 reduction potential in waste management in Europe and the possible contribution to the CO2 reduction target in 2020

The results are that the current legislation including the effect to of new Waste Directive could lead to further reductions of up to 200 Mt CO_2 equivalents. If this is seen as the best estimate of the full implementation of the EU waste legislation by 2020, and using the current EU ETS price for carbon (15 EUR per tons CO_2 equivalent) the total value of the reductions is about 3 billion EUR. This is an indication of the costs of not realised CO_2 reductions of not fully implementing the waste legislation including the future agree targets.

Important factors regarding the waste sector's GHG contribution include:

- Diversion of waste from landfills to recycling or recovery
- The energy substituted in case of energy recovery; and
- The recycling of material that substitutes the use of virgin raw material.

The more waste is diverted from landfills the higher the reduction in GHG emissions. With energy production expected to include less fossil fuels, the future gain from using waste as fuel will be reduced. More recycling which reduces the use of energy intensive raw materials contributes to reducing overall GHG emissions. Recycling of combustible materials as paper, cardboard and plastics will result in even higher reduction of GHG emission compared to incineration of the same materials.

Waste means upstream emissions related to the raw materials and manufacturing of the goods and downstream emissions in relation to waste management activities. Prevention of waste means less production of raw materials and less process into final goods and the avoided GHG emissions are much larger than the direct emissions form the waste sector.

A.4. Findings regarding the waste sector

The previous sections have analysed selected aspects of the waste legislation include examples of the costs of not implementing the legislation. A recent study has developed two scenarios for the situation in 2020:

- Scenario A: Waste legislation implemented as by 2006
- Scenario B: Full implementation of all element of the waste legislation (prevention and recycling)

The scenarios include projection of the waste generation up to 2020. The analysis gives a comprehensive estimate of the costs associated with not fully implementing the legislation.

Table A-15 Difference in waste generation and recycling between current (2006) and full implementation of waste legislation in year 2020

		Scenario A	Scenario B	Difference (B-A)		Difference (B-A) in % of A
Waste generation						
Total	Mt	4,854	4,463	-391		-8
MSW	Mt	337	289	-48		-14
C&D	Mt	2,126	2,020	-106		-5
Other	Mt	2,391	2,154	-237		-10
Treatment						
Landfilling/Incineration without energy recovery, other disposal	Mt	3,799	2,524	-1,713		-34
of which MSW	Mt	272	70	-202		-74
Material recovery	Mt	951	1,637	687		72
Energy recovery	Mt	106	302	196		185
Energy recovery	PJ	1,544	4,309	2,765		179
GHG emissions						
GHG emission avoided by material and energy recovery	$Mt_{CO2,e}$	209	447	239		114
GHG emission from MSW landfilling	$Mt_{CO2,e}$	168	43	-125		-74
Total difference in GHG emission	$Mt_{CO2,e}$			**363**		

Source: Bio Intelligence Service 2011, "Implementing EU waste legislation for green growth".

Based on the difference in material flows and GHS emissions, the economic value of the difference has been estimated. The results are significant costs of not fully implementing the waste legislation. The revenues from recycled materials and the environmental costs account for the largest shares of the costs.

Table A-16 Total benefits of the full implementation of the waste legislation compared to current (2006) implementation in year 2020 in billion EUR

	Scenario A	Scenario B	Difference (B-A)
Revenues from recycled materials	38.4	72.5	34.1
Revenues from recovered incineration energy	6.5	18.1	11.6
Revenues from recovered landfill gas energy	0.5	1.4	0.9
GHG emissions avoided	16.3	34.9	18.6
Avoided acidification	14.1	27.9	13.8
Avoided eutrophication	27.7	39.4	11.7
Total value generated	**103.5**	**194.2**	**90.7**

Source: Bio Intelligence Service 2011, "Implementing EU waste legislation for green growth".

The result suggests that the costs of not implementing the legislation would amount to 90 billion annually by year 2020.

This estimate provides an indication of the order of magnitude. Factors that could mean that it is either too high or too low include:

- Some progress in implementation could have taken place since 2006 - making the estimate too high;
- The value of avoided GHG emissions is estimated using damage costs of 78 EUR/tons. If it is assumed that additionally avoided GHG emission replaces other emission reduction activities, a carbon price based on for example the EU ETS would be a better indicator (current ETS prices is around 15 EUR/ton CO_2 equivalent). This makes the estimate too high;
- Containment costs of non-compliance landfills are not included in the estimate - making it too low;
- Repatriation costs for illegal export is not included in the estimate - making it too low;

- Health damage costs are not included - making the estimate potentially to low;
- Environmental damage from eco-toxic pollutants is not included;
- Damage costs in non-EU countries are not included.

Most of the factors points to the estimate as being too low.

The cost estimate is for the year 2020 where the waste generation has increased compared to the current level. The today's costs of not having fully implemented the waste legislation are therefore lower.

Assuming that the majority of the costs relates to avoided use of virgin materials when prevention and recycling of materials are higher it possible to give a rough indication of costs of the current implementation gap.

The costs that are associated with current 2011 gap in implementation are lower that the estimated 90 billion EUR. If it is assumed that current gap does not include the waste prevention and that only half of the additional recycling is related to already binding targets, then a rough indication can be given. About 30% of the reduced amount landfilled is from prevented waste, see Table 4-5, and assuming that the half of the rest of the not landfilled amount is due to current target; the total amount less deposited at landfills is about 35% of the amount for the 2020 scenario. Further assuming that all costs relate proportionally to amount of waste landfilled, the total costs of not implementing are about 30 billion EUR regarding the current implementation gap.

In addition to economic and environmental costs, the lack of implementation means less activity in the waste manage and waste recycling sectors. The effects have been estimated along side the costs and the results are shown in the below table.

Table A-17 Effect of implementation gaps on turnover and jobs in the water sector in 2020

Parameter	Unit	Scenario A	Scenario B	Difference (B-A)
Turnover in "waste management" sector	in billion €	113	132	19
Turnover in "recycled materials" sector	in billion €	42	72	30
Total turnover	**in billion €**	**155**	**204**	**49**
Jobs in "waste management" sector	in million	1.8	2.1	0.3
Jobs in "recycled materials" sector	in million	0.4	0.8	0.3
Total jobs	**in million**	**2.2**	**2.8**	**0.6**

Source: Bio Intelligence Service 2011, "Implementing EU waste legislation for green growth"

There are a significant number of jobs - in the order of 600,000 - that are not created due to the implementation gaps

A.5. Overview

Table A-8 presents the key findings.

Table A.18 Overview of waste sector costs of not implementing the legislation

Policy targets		Environmental costs including GHG emissions	Economic costs	Social costs
Waste prevention	Decoupling of GDP and waste generation has not been achieved	Significant benefits of more prevention maybe up to 15 billion for reduced life-cycle environmental costs	Significant savings if more prevention is realised. A lot of the savings will be reduced expenditure of saved products/material	
Recycling	Currently overall recycling rate below 50%	Significant costs of not recycling - estimates at up to 30 billion annually	Not realised revenue s from recycling at up to 45 billion annually	Additional jobs could be created - up to 600,000 by 2020
Landfill	A substantial number of landfills do not comply with the standards. Estimated that around 15% of total MSW may go to dump sites	Environmental costs of MSW to dump sites could be more than 5-600 million EUR per year	Risk of future clean-up costs related to contaminated dump sites	Health and other damages from non-compliant landfill - included in estimate of environmental costs.

Implementation gaps

The implementation gaps relates to recycling of most fractions. Currently, there is a gap at the EU level in terms of the overall recycling, though some Member States have achieved the current targets. Most Member States could recycle more and full implementation is understood as relating future recycling targets.

Costs of not implementing the acquis

The costs related to not realising the environmental benefits of waste recycling are very significant. These are the costs of life cycle emissions from the vigina materials that would have been avoided with higher recycling rates.

Most waste has a material resource value as re-used or recycling material. Low re-use and recycling rates means that the value of the waste as secondary material is not realised.

If proper collection and sorting facilities would be in place in all Member States, there would be more recycling material to process and supply as re-usable or recycled materials. If the economies of scale in the recycling process then lack of implementation lead to too high costs of recycling. Also the reliability and quantities supplied of the market for recycled material might have an effect on how such markets develop. It might be difficult for any industry to base its production on the use recycled materials as input if the markets are not sufficiently mature.

Appendix B Biodiversity and nature

B.1 Introduction

Biodiversity[31] enables ecosystem services including the production of food, fuel, fibre and medicines, regulation of water, air and climate, maintenance of soil fertility, cycling of nutrients. Biodiversity is in essence instrumental for a prosperous and sustainable Europe.

Costs for not implementing the biodiversity aspects of the environmental acquis are potentially huge. On a global level, failing to reach a 2010 target is estimated to cost 545 billion Euros equivalent to just less than one percent of global GDP. [32] The recently released Economics of Ecosystems and Biodiversity (TEEB)[33] study also concludes that, in a "business as usual" scenario, the current decline in biodiversity and related loss of ecosystem services will continue and even accelerate and that by 2050 the estimated further loss of the natural areas that still existed in 2000 will be 11 percent. In economic terms the loss of ecosystem services by 2050 in this scenario represents an annual welfare loss estimated at six percent of global GDP.[34] Scientists, economist and policy makers are increasingly becoming aware of the huge losses in costs for not halting biodiversity loss.

Method and delineation

The two key pieces in EU biodiversity legislation are the Birds (2009/147/EC) and Habitats (92/43/EEC) Directives. Together they establish the Natura 2000 network of protected areas, currently covering about 18% of European territory. However, the scope of European biodiversity policy has grown substantially over the last decade. The current policy framework comprises a range of action plans and bordering legislation, as well as international treaties such as the Convention on Biological Diversity (CBD) (see table).

[31] Meaning the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, also including diversity of genes, species and ecosystems.

[32] EC (2008) The Cost of Policy Inaction (COPI): The case of not meeting the 2010 biodiversity target. Download from: http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/copi.zip

[33] http://www.teebweb.org/

[34] Pavan Sukhdev, Study Leader of TEEB and Managing Director and Head of Deutsche Bank's Global Markets

Legislation/Policy development	Year	Key elements
Conservation of Wild Birds Directive (79/409/EEC, codified in 2009/147/EC)	1979	• Aims to protect, manage and regulate birds living in the EU including their nests, habitats and eggs. • Require MS to assign Special Protection Areas (SPAs)
Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC)	1992	• Aims to contribute to biodiversity by protecting natural habitats of flora and fauna in MS. • Require reporting on progress every 6^{tth} year. • Require MS to assign Special Areas for Conservation (SPCs).
European Biodiversity Strategy	1998	• Aimed to anticipate, prevent and attack the causes of significant reduction or loss of biodiversity at the source
EU Heads of States adopt target to halt biodiversity loss by 2010	2001	• At the EU Summit in Gothenburg in June 2001, EU heads of state conclude that: "biodiversity decline should be halted with the aim of reaching this objective by 2010."[35]
Biodiversity Action Plans (BAP)	2001	• Aimed to boost implementation in line with the 1998 Strategy
Communication: "Halting biodiversity loss by 2010" (COM/2006/0216) + EU Biodiversity Action Plan	2006	• Underlines the importance of biodiversity for sustainable development • BAP sets out 10 priority actions, in four policy areas, and translated into 154 individual policy actions
Mid-term assessment of the BAP (COM/2008/864)	2008	• Stated that EU was highly unlikely to reach its 2010 target
Spring European Council (EUCO 7/10)	2010	• EU heads of state commit to new 2020 target to halt biodiversity loss.

In order to delineate the nature and biodiversity sector but still retain some of the broad scope of legislation the assessment will focus on the newly set overall target and (still to be defined) supporting sub-targets. **It means that quantifiable targets will not be analysed as such but focus will rather be on lost benefits from not providing enough support to general biodiversity goals**.

The headline target reads: "*Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss.*" It is in turn supported by sub-targets which are currently being decided in detail. We argue that even though the target has been postponed to 2020 the costs for not implementing the environmental remains.

[35] EC (2001) Presidency Conclusions Göteborg European Council 15 and 16 June 2001. (SN 200/1/01 REV 1)

The following list includes the areas on which this report will focus:

1. Integration and sustainable use of resources
    a. Forests
    b. Agriculture
2. Overexploitation
    a. Fisheries
3. Fragmentation and green infrastructure
4. Nature conservation
    a. Birds Directive
    b. Habitats Directive
5. Invasive Alien Species (IAS)
6. Contribution to global biodiversity

For some species and habitats, data analysis allows for generating overall trends of loss, however, the analysis will be limited to available data. For example, the spread and presence of butterflies and birds are fairly well covered whereas almost no data exist on many other species.

Establishing the cost of not implementing the environmental acquis requires two steps: 1) determining the trends in biodiversity loss, and 2) illustrate the costs incurred on Members States for losses.

Step1: Indicators for biodiversity loss has recently been streamlined in the so called SEBI set.[36] It contains 26 indicators of which some are of interest for this study. Some of the SEBI indicators are incorporated in this study. In function of data availability the cost of not implementing biodiversity and nature legislation will focus on:

- Abundance of and distribution of selected species
    - European Red List Index for threatened species
    - Species of European interest

[36] http://biodiversity-chm.eea.europa.eu/information/indicator/F1090245995

- Ecosystem coverage and habitats
  - Nationally designated protected areas
  - Site designation under the Birds and Habitats Directives
  - Status of High Nature Value (HNV) farming
- Trends in invasive alien species
- Marine biodiversity[37]
  - European commercial fish stocks
- Forests
  - Growing stock, increment and fellings
  - Deadwood

Step 2: After indicating the loss of biodiversity in Europe the next step is to illustrate the cost incurred for doing not implementing the acquis. An initial literature review results in the following cost elements related to biodiversity loss:

- GHG mitigation
- Tourism and recreation
- Water purification
- Pollination
- Invasive alien species
- Pharmaceuticals
- Food production
- Etc...

A few of these elements are better researched than others. In particular GHG mitigation, tourism and recreation, and cost of invasive alien species have been better defined. With regards to Natura 2000 sites, Kettunen et al (2007) de-

[37] Could overlap with the Water sector.

scribes well the associated benefits and how to value them in their "Assessing socio-economic benefits of Natura 2000: a toolkit for practitioners".[38]

Finally, it might be fruitful to briefly comment on the theoretical framework and challenges for ecosystem valuation. First of all, sufficient biodiversity levels are needed for ecosystems to provide so called ecosystem services. These are normally divided into **provisioning services**: such as food, drinking water and raw materials; **regulating services** such as carbon sequestration, waste treatment and water retention; **cultural services** such as recreation and amenity values; and finally, **habitat or supporting services**, such as maintaining genetic diversity and seed and nutrient dispersal.

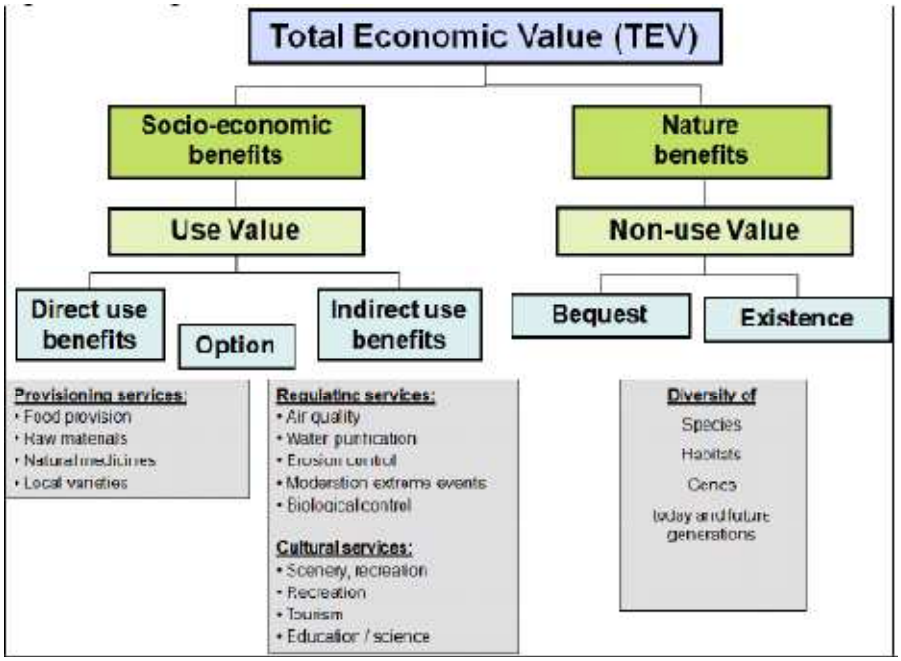
Ecosystem valuation is used to assign a monetary value to the different services. A whole discipline on environmental economics has taken up the challenge on monetising ecosystem services which are often not easy to value.

The benefits of some of the services are more straightforward to monetise. These are often provisioning services, such as raw materials and food provisioning, where market-based approaches often are suitable.[39] Others are more difficult to analyse, for example landscape, cultural values, trailing routes, nutrient cycling and other regulating services.[40] The Total Economic Value framework can be used to take a snap-shot of ecosystem valuation. Simply put, one might say that going from left to right, the benefits of ecosystem services are increasing in abstraction. Direct Use Benefits often have proxy values in existing markets such as agriculture commodities or raw materials, where as intrinsic values one the left side, demands more abstract valuation methods such as Willingness to Pay.

[38] Kettunen, M., Bassi, S., Gantioler, S. & ten Brink, P. 2009. Assessing Socio-economic Benefits of Natura 2000 – a Toolkit for Practitioners (September 2009 Edition). Output of the European Commission project Financing Natura 2000: Cost estimate and benefits of Natura 2000 (Contract No.: 070307/2007/484403/MAR/B2). Institute for European Environmental Policy (IEEP), Brussels, Belgium. 191 pp. + Annexes.

[39] Pascual, U. and R. Muradian (2010) The economic of valuing ecosystem services and biodiversity: chapter 5 (TEEB). March 2010

[40] Pascual, U. and R. Muradian (2010) The economic of valuing ecosystem services and biodiversity: chapter 5 (TEEB). March 2010



Ecosystem service valuation is clearly a rather nascent and undefined area. The theoretical foundations are beginning to emerge; however, applied environmental economics still needs much work. Nevertheless, it is not the task of this study to examine different techniques of determining the benefits of maintaining biodiversity levels, however, the outlined framework above provides some insight in jargon and thinking-patterns of our attempt to establish the costs of not implementing the environmental acquis.

B.2 Findings regarding the nature and biodiversity sector

The following sections provide examples of expected costs and benefits for six areas which the Commission has indicated as important for the post-2010 target.

B.2.1 Integration and sustainable use of resources

The integration and sustainable use of resources focuses in this report on high Nature Value (HNV) farming and Forestry. These areas have been indicated by the Commission to be of particular importance and tentative targets are under discussion for HNV farmland. For forestry, targets are still missing.

High Nature Value Farmland

Gap assessment

Key parts in the integration and sustainable use of resources is the support to extensive agriculture (as opposed to intensive agriculture).

The following aspects to be included in a sub-target are currently under review:

- **% of land under a contract to deliver HNV related farming and forestry within and outside HNV areas;**

- **% of CAP direct support directed to HNV (area/farming to be determined) to contribute to good conservation status.**

Extensive agriculture, low intensive farming and High Nature Value farming are all expressions of farming with low inputs of fertilizers, labour and capital over relatively large areas of land. High Nature Value (HNV) farming has become the accepted term in European policy circles and is mainly present in the biodiversity parts of CAP support in the forms of agri-environmental schemes and cross-compliance mechanisms.

HNV farming roughly covers 1/3 of European agricultural land with extensive grasslands used for grazing taking up the lion's share. HNV farming is spread especially in Eastern and Southern Member States where agricultural practices have not undergone the intensification experiences in older Member States. The status and trend of HNV farming in Europe is still under developments, however, the EEA notes a 2.6% decline in extensive agriculture from 1990 – 2006.

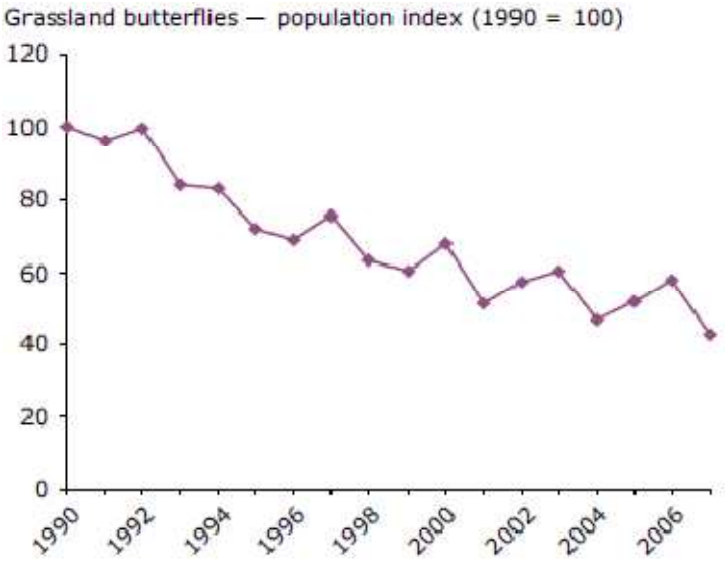
Environmental costs

HNV farmland provides key habitats for birds, butterflies and other species. Additionally, the farming practices use low inputs of chemical pesticides, low level grazing of wetlands, leaving some areas of scrub, fallow or vegetated under storey to fruits or olive trees.[41] Additionally, HNV farmland is likely to maintain nutrient levels, water, air and soil quality. Finally, large grazing fields are great sequesters of carbon. In the event of abandonment or intensification, these benefits are lost.

A telling example of HNV farmland importance is the abundance of butterflies. Butterflies are highly dependent on semi-natural grasslands. Some 92% of all targeted depend on agricultural habitats.[42] The population is, however, threatened by both intensification and abandonment. About 80% of so called Prime Butterfly Areas are negatively affected by intensification and/or abandonment. 43% of all agricultural sites suffer from intensification and 47% from abandonment. In 10% of the cases, the site is impacted by both threats simultaneously. The result is a 60% decline in targeted butterfly populations since 1990 and the trend shows no sign of fading out.

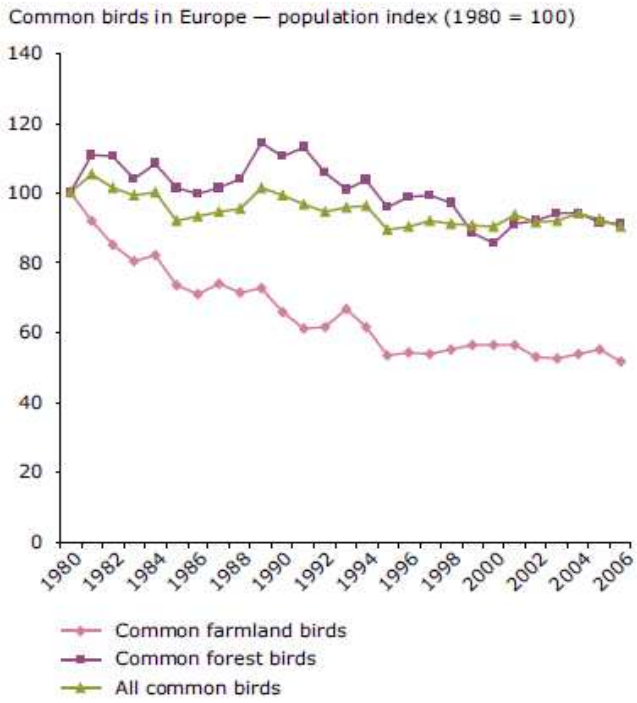
41 WWF (2010) *CAP reform 2013 last chance to stop the decline of Europe's High Nature Value farming?*

42 EEA (2009) *Distribution and targeting of the CAP budget from a biodiversity perspective*. EEA Technical Report No. 12/2009



Source: EEA (2009) *Distribution and targeting of the CAP budget from a biodiversity perspective*. EEA Technical Report No. 12/2009

Farmland birds are also often considered a good indicator for measuring the health and changes in EU agricultural biodiversity. Between 1990 and 2002 there was an average of 50% decline in farmland bird populations.[43] In particular if one compare the number of farmland birds to forest birds, there is a clear trend in decline of the former (See figure).



Source: EEA (2009) *Distribution and targeting of the CAP budget from a biodiversity perspective*. EEA Technical Report No. 12/2009.

[43] EEA (2009*) Distribution and targeting of the CAP budget from a biodiversity perspective.* EEA Technical Report No. 12/2009.

The environmental costs of not preserving HNV farmland severe in terms of biodiversity levels. Both bird and butterfly populations show the clear trends in declining biodiversity levels in the EU's agricultural landscape.

Economic costs

HNV farming is a very cost-effective measure for conserving biodiversity as it brings economic and social benefits while preventing the negative aspects of intensification and abandonment.

The economic benefits of disaster prevention from HNV farming are also large. In Switzerland, grazing in the alpine regions is credited with preventing avalanches since long grass provides gliding terrain for snow.[44] In southern France, grazing prevents fires and in some instances this is acknowledged by decision-makers by small payments for the service.[45]

However, the economics of HNV farming are often signified by high labour intensity and low marginal output. The loss of HNV farming is essentially a socio-economic problem as economic incentives are lacking for the individual farmer which leads to intensification or more often abandonment of HNV farmland. Once a land is left or changed, it is nearly impossible to return to its natural state.

Social impacts

Social impacts of HNV farmland are mainly of amenity values. Farming techniques used and life-styles are often traditional which maintains the cultural heritage of European agriculture. The direct economic benefits (in terms of crop yields) of HNV farming are small and in many cases the socio-economic factors are not favourable. It is clear that the low intensity farming will have large difficulties in competing with intense, more conventional, farming practice. The result is in some cases poor incomes and dissatisfaction with current practices of farming leading to an ageing and shrinking population of farmers mostly part-timers.[46]

Forestry

Gap assessment

Forests are among the terrestrial systems on Earth with the highest levels of biodiversity. A healthy forest ecosystem can provide jobs, raw material, renewable energy and income. It also sequesters carbon, regulate soils and freshwater supplies. Hence the potential benefits of implementing environmental regulations with connection to forests are many.

Forests and wooded lands currently cover some 40% of EU land area and Europe holds 5% of the world's total forests. [47] Also interesting to know is that

[44] Biber, J.P. (2006) *Review of the literature on pastoral economics and marketing: Europe.* Report prepared for the World Initiative for Sustainable Pastoralism, IUCN EARO

[45] Ibid.

[46] Smith et al (2010) *Case Studies on High Nature Value Farming in Ireland: North Connemara and the Aran Islands*. The Heritage Council, Field trip to North Connemara, July 2010

[47] EC 2010 Green Paper On Forest Protection and Information in the EU. SEC(2010)163 final

about 60% of forest is privately-owned and 40% publicly-owned in Europe. Furthermore, large parts of forested land are situated in Natura 2000 designated areas. Compared to agriculture, the percentage is substantial and almost 20% of EU forests are located in Natura 2000 areas. For some countries, such as Belgium and Cyprus, almost 50% of all forests are located in Natura 2000 areas.

Forestry is normally a matter for Member States to individually decide on. Furthermore, there are several private initiatives, such as the Forest Stewardship Council (FSC) which are particularly successful in promoting sustainable harvesting of timber by issuing certificates. Hence, the implementation of an environmental acquis and policy initiative from an EU level is difficult to causally link with environmental, economic and social costs.

Environmental costs

The main environmental cost of lost forests is the loss of forest biological diversity. Forest biodiversity is particularly important for forest living species and the breeding and sustainability of trees. The ecosystem services provided are plentiful and include air-cleansing, climate protection, carbon storage, regulation of water flows, reducing noise, and protection of erosion.

Even if planted forests are to prefer compared to clear-cutting, environmental costs are incurred even if trees are replanted. EEA recently reported that old and semi-natural forests holds a particular value in maintaining forest biodiversity and genetic variety in forests is essential for the ecosystems to remain resilient and adapt to climate change.[48] The FAO echoes a similar message when reporting on the importance to maintain genetic diversity in forests in the latest Global Forest Resources Assessment 2010.[49]

Economic costs

The economic benefits of high forest biodiversity are numerous. Carbon sequestration may belong the most valuable ecosystem services but also pollination, removal of air pollution, habitats, tourism and recreation all benefit from healthy forests.

Sequestering carbon might be the most potent economic benefit of increasing forest cover and maintaining forest biodiversity levels. Kauppi et al (2008) argue that, between 1990 and 2005, expansion of above-ground tree vegetation in the 27 EU countries annually absorbed an additional 126 million tonnes of carbon per year which is equal to 11% of the region's emissions.[50] Assuming a price of €15/tonne of carbon, the total economic benefit of sequestration would be some €1.890 billion/year on an EU average. However, Kauppi et al also shows that total carbon sequestered by EU forests relative to national emissions varies widely between Member States. In Latvia, for example, forests more than offset per capita emissions. And forests in Lithuania, Sweden, Slovenia,

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48 EEA (2010) Biodiveristy and ecosystems in Europe. April 6, 2010. Part of the series "10 messages for 2010", European Environmental Assessment Agency. (http://www.eea.europa.eu/highlights/biodiversity-and-forest-ecosystems-in-europe-1)

49 FAO (2010) Global Forest Resources Assessment 2010. FAO forestry paper 163.

50 Kauppi, P. E, L. Saikku, A. Rautianien (2008) *The sustainability challenge of meeting carbon dioxide targets in Europe by 2020.* Energy Policy Volume 36, Issue 2, February 2008, Pages 730-742.

Bulgaria and Finland absorb a large part of national emissions. At the other end of the scale are lightly-forested countries such as Belgium, Ireland, the Netherlands, Cyprus and Denmark.[51]

In a more advanced attempt to put a price on carbon sequestration from forests in the UK, a group of researchers modelled the social value of carbon at different discount rates and carbon prices. The study concluded that the minimum Net Present Value of woodlands in the UK in 2001 was $82 million with a possibility to add $72 million with subsequent afforestation.[52] The gains are highly sensitive to discount rate used and the price on carbon.

Social costs

In most developed countries the social benefits of forests mainly manifests themselves through amenity and recreational values. To assess the monetary value of these aspects poses large methodological hurdles. Moreover, many European countries (such as Finland and Sweden) maintain large areas of forests for economic purposes which employs thousands of people. According to a WHO study, in 2000, forestry employed 11 million people with 6 million engaged in direct primary production of goods. Europe's share of these was 946,000 person years.[53] According to Eurostat, this number is significantly higher. In 2005 forest-based industries included around 350.000 companies with some 3 million employees. The number of people employed by forest-based industries was 8.6 % of the total manufacturing labour force. In terms of output, these industries contributed 8.6 % of total manufacturing turnover yet only produced 7.1 % of value added.[54]

B.2.2 Overexploitation

Gap assessment

Fisheries are not the only example of overexploitation in Europe however it is the most serious and therefore has been chosen by the European Commission to be the focus of policy interventions. In the Biodiversity Action Plan (BAP) from 2006 two problems were acknowledged with regards to fisheries: over-fishing and pollution. Since pollution is mainly related to other policies such as air pollution and industry, over-fishing will be the focus of this report.

For sub-target 2, the discussions on targets are on-going and the concept of Maximum Sustainable Yield (MSY) is brought up as a possible indicator.

To briefly explain the MSY concept, the graph below shows the effects of increasing exploitation rates in a model fishery. The Mean L_{max} is the average maximum length that the fish can reach. Collapsed species are those for which

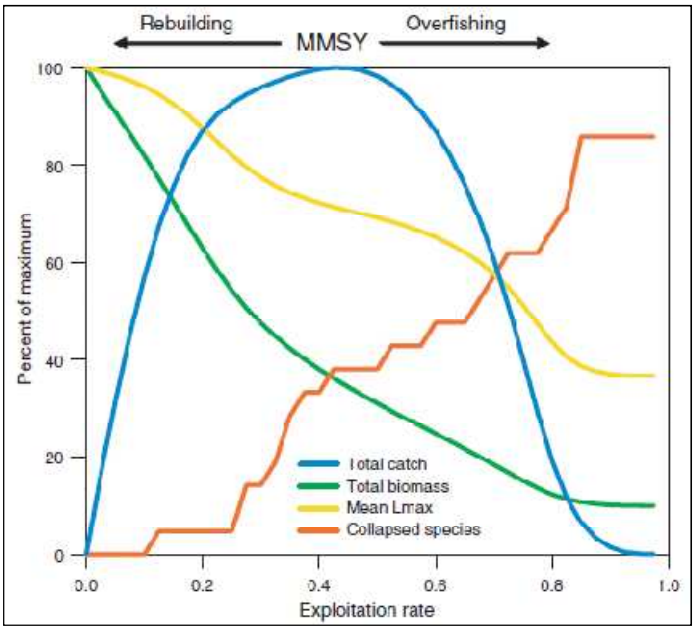
51 http://www.sciencedaily.com/releases/2007/11/071129113752.htm

52 Brainard, J., I. Bateman, A. Lovett (2005) *The social value of carbon sequestered in Great Britain's woodlands.* CSERGE Working Paper EDM 05-03

53 WHO (2005) *Global Forest Resources Assessment 2005, Progress towards sustain able forest management.* Chapter 7 Socio-economic functions. p.118

54 Forest-based industries (2008) http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Forest-based_industries.

stock has declined to less than 10% of their unfinished stock. If the exploitation rate moves left on the X-axis, rebuilding of the stock can occur. If it moves to the right, over-fishing is likely. [55]



Source: Worm B et al., Science 325, 2009

Three key management objectives can be derived from the graph:

- biodiversity is maintained at low exploitation rate;
- maximum catch is maintained at intermediate exploitation rate;
- and, high employment is often maintained at intermediate to high exploitation rate, because of the high fishing effort required.[56]

Currently, 70% of the EU's commercial stock is being exploited beyond Maximum Sustainable Yield (MSY) levels.[57] 30% of these stocks are fished outside of their biological limits, i.e. they are not able to replenish. For example, 93% of all the cod fished in the North Sea is taken up before it can breed. [58]

The gap to the target is clearly considerable. Decision-makers are struggling with structural problems such as bloated fleet capacities, lack of implementation, short terms focus in decision-making and lack of responsibility from the industry.

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55 Worm, B. et al (2009) *Rebuilding global fisheries.* Science vol. 325

56 Worm, B. et al (2009) *Rebuilding global fisheries.* Science vol. 325

57 EEA (2010) *The European Environment: State and Outlook 2010.* Thematic Assessment: Marine and Coastal Environment.

58 EC (2009) *Reform of the Common Fisheries Policy*. GREEN PAPER COM(2009) 163

The next sections elaborate on the environmental, economic and social costs of not reaching the 100% MSY target.

Environmental costs

The environmental costs for over-fishing are both direct and indirect. The direct effects include growth overfishing which means that larger individuals of a species are removed, leaving smaller and younger populations. When growth overfishing reaches a point where the young population is incapable of replenishing, one speaks of recruitment overfishing and has serious detrimental effects and bears significant environmental costs.[59]

Moreover, there are indirect effects when the top predators are removed from the food-web (called trophic cascading effects). The effects are often found in change of habitats and/or other parts of the ecosystem of which the fish took part. [60]

Over-fishing is one of several pressures and cause of a continuously deteriorating marine environment which often contain feed-back loops. Other pressures include: aquaculture, use of pesticides and fertilisers in agriculture, chemical pollution from industries and shipping, and exploitation of oil, gas and other resources. [61]

An example of several factors having negative impact on fish stock is found in the Anchovy stock in the Black Sea. According to USSR data gathered from acoustic surveys conducted between 1980-1988, the average of Black Sea anchovy was 309.000 tonnes and Azov Anchovy 169.000 tonnes.[62] After 1988 the population dramatically decreased. The key reason was first thought to be the introduction of an invasive alien species (IAS), the jellyfish *Mnemiopsis Leidyi*. Key evidence of the negative impact of the jellyfish was observed when the stock of anchovies increased up to 165.000 tonnes outside the Georgian coast simultaneous to the disappearance of the IAS. [63] Simultaneously, there was a steep inflow of nutrients rich run-off from the Danube river causing caused eutrophic conditions including intense algal blooms resulting in hypoxia and the subsequent collapse of benthic habitats on the northwestern shelf.[64] Finally, heavy over-fishing by mainly Russian and Turkish fishing fleets eventually let

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59 Atalah, J. (2010) Over exploitation: Marine Biodiversity Wiki. Marbef/Encora (http://www.marbef.org/wiki/Over_exploitation)

60 Atalah, J. (2010) Over exploitation: Marine Biodiversity Wiki. Marbef/Encora (http://www.marbef.org/wiki/Over_exploitation)

61 EEA (2010) *The European Environment: State and Outlook 2010.* Thematic Assessment: Marine and Coastal Environment.

62 Chashchin, A. K. (1996) *The Black Sea population of anchovy*. Scienta Marina 60 (Supl. 2): 219-225

63 Chashchin, A. K. (1996) *The Black Sea population of anchovy*. Scienta Marina 60 (Supl. 2): 219-225

64 Langmead, O.; McQuatters-Gollop, A.; Mee, L.D.; Friedrich, J.; Gilbert, A.J.; Gomoiu, M-T.; Jackson, E.L.; Knudsen, S.; Minicheva, G. and Todorova, V. (2008) *Recovery or decline of the northwestern Black Sea: A societal choice revealed by socio-ecological modelling*. Ecological Modelling 220 (21), 2 927–2 939.

to a collapse of the anchovy fisheries. Hence the collapse was the result of over-fishing in combination of eutrophication, and IAS.[65]

Of all marine habitats and species that have been assessed in Europe[66], only 10% of the habitats and a mere 2% of species were deemed favourable. [67] Reasons for declining fishing-stock are clearly not limited to over-fishing. However, it is a strong contributing factor to the current state of EU's marine environment.

Economic costs

There is ample evidence that not following sustainable catch levels could incur substantial costs on both fisheries industries and connected communities.

The most frequently noted example comes from Canada. In 1968, fisheries off the north coast of Newfoundland harvested more than 800,000 tonnes of Cod annually.[68] It played a pivotal part in the economic development in the coastal regions and created thousands off jobs related both directly and indirectly to the fishing. However, due to heavy over-fishing the total catches declined. The situation worsened to such an extent that the fishery collapsed and in the 1990s and 99% of the cod disappeared in New Foundland. By 1993, all Canadian cod fishing was banned and over 40,000 people lost their jobs. Still, coastal communities are still struggling to recover and cod fisheries are not experiencing any drastic increase in total catches. The table below shows the developments over the last 19 years:

Commercial cod landings in the Canada Atlantic coast[69]

Year	Live Weight (metric tonnes)	Total Value (CA$)
1990	395,024	$243,822,000
1991	309,923	$227,916,000
1992	187,953	$153,388,000
1993	76,645	$66,325,000
1994	22,714	$29,610,000
1995	12,490	$18,133,000

65 Oguz, T. B. Fach, and B. Salihoglu (2008) Invasion dynamics of the alien ctenophore Mnemiopsis leidyi and its impact on anchovy collapse in the Black Sea. Journal of Plankton Research vol. 30 No. 12. pages 1385-1397

66 In the EEA's assessment, 40% of the marine habitats and a majority of the species Were categorised as "unknown".

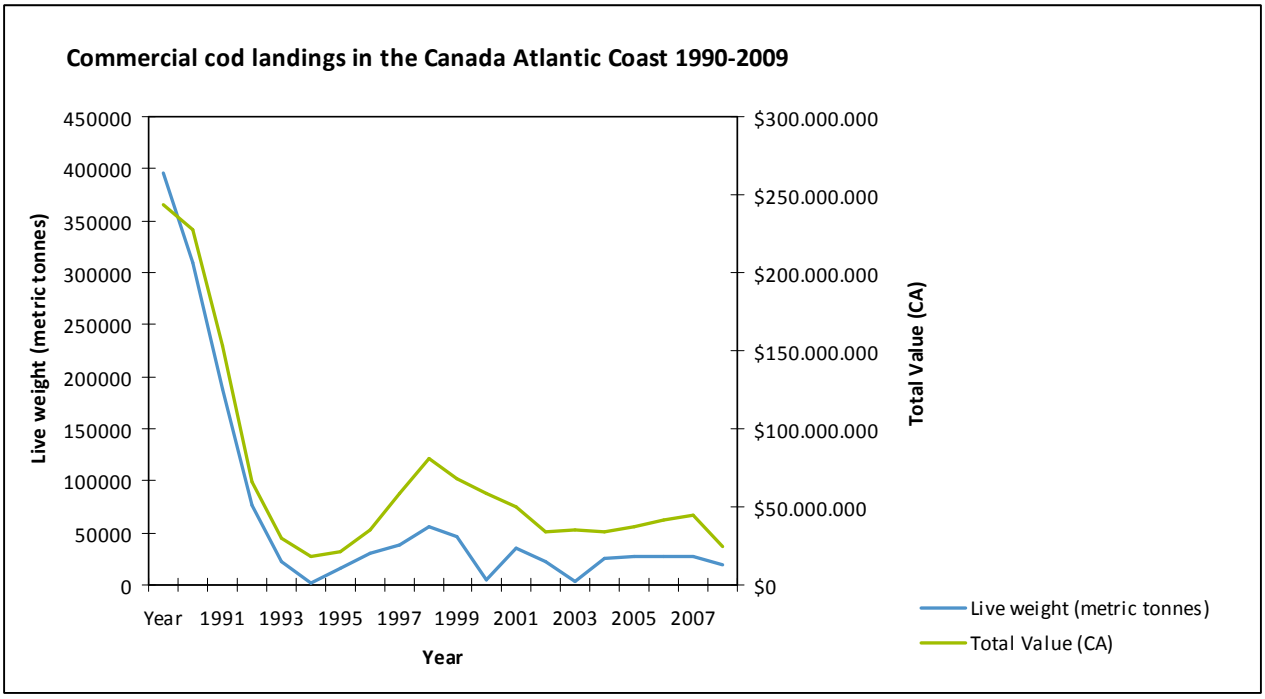
67 EEA (2010) *The European Environment: State and Outlook 2010.* Thematic Assessment: Marine and Coastal Environment.

68 DFO-MPO (2002) State of Canada's fishery 2002. http://www.dfo-mpo.gc.ca/media/infocus-alaune/2003/20031205/cod-eng.htm

69 Ecorys, 2011 (data gathered from Fisheries and Oceans Department Canada, http://www.dfo-mpo.gc.ca/stats/commercial/sea-maritimes-eng.htm).

Commercial cod landings in the Canada Atlantic coast[69]		
1996	15,544	$21,374,000
1997	29,899	$35,320,000
1998	37,809	$58,792,000
1999	55,478	$81,082,000
2000	46,177	$68,510,000
2001	40,440	$58,459,000
2002	35,741	$49,494,000
2003	22,768	$33,540,000
2004	24,730	$35,415,000
2005	26,156	$34,001,000
2006	27,307	$37,027,000
2007	26,593	$41,415,000
2008	26,833	$45,048,000
2009	19,900	$24,373,000

In the following graph the same data is transformed into a graph show the dramatic drop in both catch and value in the early 90s. Notable is also that both total catch and total value have remained relatively low over the last 15 years.



Source: Ecorys, 2011 (data gathered from Fisheries and Oceans Department Canada http://www.dfo-mpo.gc.ca/stats/commercial/sea-maritimes-eng.htm)

The change in fisheries management approach to stay within MSY levels would require a drastic down-sizing of the European fishing fleet since current capacity greatly exceeds marginal sustainable yield levels for most fish stocks.[70] This implies large initial investments.

In the long run, however, the implementation of MSY-based management practices is expected to stabilise and maybe lead to an increase of economic prosperity levels of a smaller group of fishermen. Additionally, it could significantly reduce the needs for government subsidies to the fishing industry because the quality and ethical soundness of sustainably managed fish – even with the associated increased prices – will be valued by consumers.[71]

In some occasions the MSY-based approach is unreliable due to insufficient or poor scientific data of fish stocks. The Commission then suggests the introduction of management-plans. For the Western stock of the Atlantic Horse Mackerel the Commission proposed such a plan in 2009.[72] The introduction of such a management plan is expected to have modest impacts on profits (or losses) in the short-term.[73] However, over the long-term, management plans would ensure

70 Green Paper: Reform of the Common Fisheries Policy. COM(2009) 163 final.

71 Green Paper: Reform of the Common Fisheries Policy. COM(2009) 163 final.

72 EC (2009) Proposal for a COUNCIL REGULATION establishing a multi-annual plan for the western stock of Atlantic horse mackerel and the fisheries exploiting that stock. COM(2009) 189 final

73 Adapted from SEC(2009) 524 final: Accompanying document to the Commission's

that profits remain stable over time, reduces the risk for collapses, such as in New Foundland, and opens up for marketing possibilities, such as eco-labelling.

		Baseline	No Action	Long-term management plan
	€ million	Profit 2006[74]	Average (2007-09)	Average (2007-09)
NL >40m	Profit	6.42	7.61	7.77
IRE >40m	Profit	3.66	1.55	1.69
IRE 24-40m	Profit	4.1	9.17	9.23
GER >40m	Profit	57.76	53.59	53.72
UK >40m	Profit	44.34	31.98	31.98
ESP	Profit	1.5	1.10	1.10

Source: Adapted from SEC(2009) 524 final: Accompanying document to the Commission's proposal for a COUNCIL REGULATION establishing a long-term plan for the Western stock of Atlantic horse mackerel IMPACT ASSESSMENT.

Management-plans are also not expected to introduce new procedures and thus not incur additional administrative costs for Member States.

In conclusion, the examples have shown that economic impacts of introducing sustainable management plans is not expected to lower profit substantially. Instead, as shown with the New Foundland case, the economic risks of continued unsustainable fisheries are considerable.

Social impacts

Over the past 17 years the EU fishing fleet capacity has already declined at a fairly steady annual average rate, a little below 2%, in terms of both tonnage and engine power.[75] Social impacts of this decline have been cushioned by specific down-sizing subsidies and support to the sector that allowed for investments to provide alternative employment opportunities to affected fishermen. The potential need to increase the down-sizing percentage in the short term due to the switch to MSY-based management practices would generate social and income effects that are concentrated in a few Member States, i.e. those with the largest amount of full-term equivalent employment in the fisheries sector, namely Spain, Greece and Italy. Some of these negative effects could be counter-acted via sound re-employment policies and potential short term financial support to the industry to facilitate the transition to reduced fleet capacity. However, estimates from several Member States have shown that the cost of

proposal for a COUNCIL REGULATION establishing a long-term plan for the Western stock of Atlantic horse mackerel IMPACT ASSESSMENT.

74 The lower future performance compared to 2006 is due to 2006 being a high -performing year in the data series.

75 "Facts and Figures on the Common Fisheries Policy", 2010 edition.

fishing to the public budgets actually exceeds the total value of the catches, and thus European citizens in practice pay twice for their fish: once in the store and once through their taxes.[76]

In sum, the main social costs in the short term for bridging the current implementation gap would be borne by the fishing sector, concentrated in a few Member States. They would hence be fairly local and with the correct policy programmes, the re-skilling and diversification of coastal communities. Finally, EU limits on fishing quotas has led to several cases of civil unrest. In 2009 in France, for example, fishermen blocked three channel ports in protest against EU measures.[77]

The long term social benefits of the policy measure, on the other hand, would be felt across society as a whole (higher quality of consumed fish, ecosystem services of sustainable fish stocks, etc.) and across all EU Member States. A sustainable yield which is maintained could continue to provide livelihood for a viable fishermen community in the EU. To really investigate the trade-offs between long and short term costs and benefits, a far more extensive analysis and research efforts than is feasible within the frames of this project would be necessary.

B.2.3 Fragmentation and green infrastructure

Gap assessment

Green infrastructure is a relatively new concept in EU policy making. It refers to the interconnected network of open spaces and natural areas, such as greenways, wetlands, parks, forest preserves and native plant vegetation, that naturally manages storm-water, reduces flooding risk and improves water quality. The basic idea is that ecosystems must be connected in order to maintain core functions and ensure long-term sustainability. Green infrastructure is part of a new and more smart conservation where semi-natural lands are connected in landscapes where economic activity is present. It hence differs from "old" conservation where preservation and protection were key.

Current pressures on biodiversity rich areas and other valuable ecosystem sites often lead to fragmentation and the creation of ecosystem "islands". These islands risk loosing their resilience, genetic diversity and even collapse completely. Hence, well-planned green infrastructure is needed as economic activity continues to put pressure on green networks.

Currently about 30 % of EU territory is considered to be moderately to highly fragmented and the Commission has taken action to spur Member States to include green infrastructure in spatial planning. In some countries, such as the UK, green elements have been integrated in spatial planning for some time now, however, a coherent policy is still lacking on a European level. In particu-

[76] Green Paper: Reform of the Common Fisheries Policy. COM(2009) 163 final.

[77] BBC (2009) French fishermen lift blockades.
(http://news.bbc.co.uk/2/hi/europe/8001780.stm)

lar, the benefits of connectivity between Natura 2000 sites show great potential. In January 2010 the Commission published a new vision and target for a post-2010 Biodiversity policy, of which a daughter strategy on green infrastructure will be developed. For the moment, the following potential formulations for a sub-target have been developed and are not mutually exclusive:

- Prioritisation of Green Infrastructure strategies incl. projects (e.g. such as of climate change mitigation/adaptation focus, and of strengthening ecosystem services) in particular under regional policy (e.g. through earmarked funding);
- Maintenance and restoration of key ecosystem services at a sufficient level;
- (connectivity and adaptation) Putting in place a Trans-European network of Green Infrastructure through dedicated funding;
- (natural capital investments) - % EU funding devoted to Green Infrastructure projects (e.g. starting with climate change mitigation/adaptation focus); and
- (fragmentation / land-use change) - no net loss of natural areas and good functioning soil including compensation obligation which could be based on the maintenance of key ecosystem services / or sealing capping.

The lack of quantifiable targets (or any target for that matter) in EU policy making makes a gap assessment for MS implementation of legislation challenging. Moreover, there is a gap in indicators to when and what constitutes a successful green infrastructure policy. Instead, the analysis will focus on existing studies of valuating green infrastructure, case studies from EU MS, and general observations from literature.

The Natura 2000 network covers approximately 18% of EU territory and provides a good start for a Green Infrastructure. Moreover, the Water Framework Directive (WSD) should add to improved management practices and water quality including more room for rivers, natural floodplains and wetlands.[78] Similarly several Member States have started to put green infrastructure in legislation and budgets for example Czech Republic, Denmark, Germany, the Netherlands and Spain. [79] However, the economic crisis has cut some of these projects, in for example the Netherlands. Still one could say that EU green infrastructure is "under construction."[80]

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78 EEB (2008) *Building green infrastructure for Europe: Special Report*. EEB and Fundacion Biodiversidad. EEB Publication Number 2008/017.

79 EEB (2008) *Building green infrastructure for Europe: Special Report*. EEB and Fun dacion Biodiversidad. EEB Publication Number 2008/017.

80 EEB (2008) *Building green infrastructure for Europe: Special Report*. EEB and Fu ndacion Biodiversidad. EEB Publication Number 2008/017.

Even if there are movements toward more and better protected areas, the European land-use is currently heavily changing. For example, urbanisation and construction cause 1500 hectares of mainly agricultural land to disappear every day and around 8000km^2 was concreted during the 1990s.[81]

The current gap to the targets is difficult to establish considering the lack of clear targets and indicators. A potential list of existing indicators looks like follows:

Environmental costs

Indicator	Description
SEBI 04	Ecosystem coverage
SEBI 05	Habitats of European interest
SEBI 13	Fragmentation of natural and semi-natural areas
SEBI 14	Fragmentation of river systems
SEBI 16	Freshwater quality
SEBI proposal	Trends in ecosystems restored
IUCN EU Red List	Percentage of species threatened by loss of habitat
EEA, ETC/LUSI	Landscape ecological potential, species specialisation index, land accounts

The environmental costs of increased fragmentation are many. The often mentioned driver of fragmentation is expansion of infrastructure such as roads, and urban sprawl. EEA makes a long list of environmental impacts of "linear infrastructure facilities":

Category	Impacts
Land cover	Land occupation for road surface and shoulders Soil compaction, sealing of soil surface
Local climate	Modification of temperature conditions (e.g. heating up of roads, increased variability in temperature) Climatic thresholds
Emissions	Vehicle exhaust, pollutants, fertilising substances leading to eutrophication Dust, particles (abrasion from tyres and brake linings)
Water	Drainage, faster removal of water

[81] EC (2010) *LIFE building up Europe's green infrastructure: Addressing connectivity and enhancing ecosystem functions*.

Category	Impacts
	Water pollution
Flora and fauna	Reduction or loss of habitat; sometimes creation of new habitat Higher levels of disturbance and stress, loss of refuges
Landscape scenery	Visual stimuli, noise Change of landscape character and identity
Land use	Consequences of increased accessibility for humans due to roads, increase in traffic volumes, increased pressure for urban development and mobility Reduced quality of recreational areas due to shrinkage, dissection, and noise

The list of environ Source: EEA (2011) Landscape fragmentation in Europe. Joint EEA-FOEN Report. No 2/2011.

mental impacts above is only an excerpt but clearly shows the multitude of effects which touches upon all ecosystem services. Yet, arguably the most prominent effect is the loss of habitat and in the long run, increases the risk of species extinction. Four main effects of infrastructural interventions on species and habitats are: decrease in size and quality of habitats; increased number of individuals killed on roads; limited access to other side of road; and, reduced resilience in populations due to smaller groups.[82]

The economic gains of maintaining or improving green infrastructure are simultaneously clear and diffuse. The clarity derives from the necessity of allowing ecosystems and habitats to connect which increases resilience and adaptation capabilities, which ultimately support all ecosystem services. However, when calculating the economic gains of green infrastructure, there is a high risk of double counting and inclusion of general economic gains for maintaining ecosystem services. In case study on the region of Northwest England, the economic value of green infrastructure and the environment was calculated to £2.6 billion and supporting 109,000 jobs.[83] Furthermore, the case study high-lights 12 points where green infrastructure is of which essence:

1. Attracting economic growth and investment by attracting and motivating staff to greener areas;

2. Increase land and property values;

3. Increase labour productivity due to proximity to green areas;

[82] EEA (2011) Landscape fragmentation in Europe. Joint EEA-FOEN Report. No 2/2011

[83] Natural Economy Northwest (2009) The economic value of green infrastructure. (http://www.nwda.co.uk/PDF/EconomicValueofGreenInfrastructure.pdf)

4. Attract and support tourism;
5. Increase and maintain produce from the land in forms of agriculture;
6. Reduce heath problems such as asthma and heart diseases related to air-pollution and stress;
7. Improved recreation and leisure;
8. Reduce pressure on drainage and flood defence; and,
9. Increase mitigation and adaptation to (climate) change. [84]

These benefits are clearly valid for both increasing green infrastructure and environmental protection and enhancement in general. Therefore, quantifications can only be made on an abstract level. Nevertheless, the economic value of green infrastructure is explored in urban planning. For example cities in the US spending $15-65 on planting a tree could reap $30-90 in environmental benefits for the same tree.[85] The trees are key to regulate water run-off, erosion, air-pollution and workers' health.

Social costs

The social benefits of green infrastructure are related to several areas adjacent to the economic benefits. The first relates to health and well-being. Increased green space and land in particular in urban areas lead to benefits which can be grouped in three main categories:

1. Increased life-expectancy and reduced health inequality;
2. Improvements in physical activity; and,
3. Promotion of psychological health and mental well-being.[86]

Forest Research shows how people tend to be more active when there are green areas at hand.

Second, the increased probability of people leaving their homes generates knock-on effects to spur social cohesion. Research indicates that 83 % more people engage in social activity in green spaces than in other spaces. [87] The

84 Natural Economy Northwest (2009) The economic value of green infrastructure. (http://www.nwda.co.uk/PDF/EconomicValueofGreenInfrastructure.pdf)

85 US EPA, *Reducing Urban Heat Islands: Trees and vegetation*. (http://www.epa.gov/hiri/resources/pdf/TreesandVegCompendium.pdf)

86 Forest Research (2010) Benefits of green infrastructure. DEFRA research contract number WC0807. October 2010.

87 Forest Research (2010) Benefits of green infrastructure. DEFRA research contract number WC0807. October 2010.

green spaces are in general free areas for leisure which tend to benefit groups from the lower socio-economic groups. [88]

Finally and generally, the social benefits of a vibrant nature are notoriously difficult to estimate. The social cost/benefits of recreation, scenery, and wild life are heavily connected to well functioning ecosystem services.

B.2.4 Nature conservation

Gap assessment

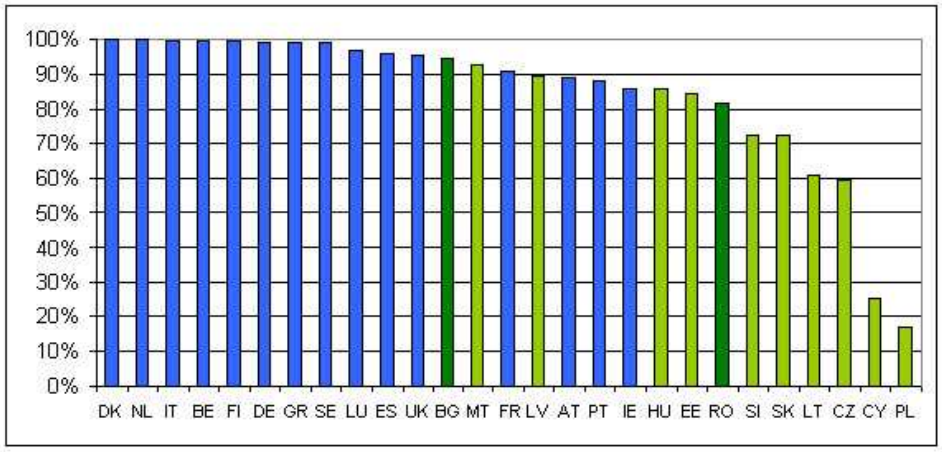
The target for the Commission regarding nature conservation are considered to be both effort-based (e.g. completion of establishment of Natura 2000; full funding of the network) and status-based (e.g. % of species/habitats protected under 'favourable conservation status', as defined in the Habitats Directive). The following working-definitions are currently under discussion:

- **20-30% of conservation status assessments (EU – bio-geographical level) for species and 30-40% for habitats are favourable or show evidence of improvement;**
- **Less than x% of species/habitats protected under EU legislation are classified as unknown;**
- **Sufficiency index for designated Natura 2000 sites;**
- **x% of funding needs for the management of the Natura 2000 network (€6 billion) met;**
- **% of Natura 2000 sites which have an appropriate management plan or equivalent instrument.**

The key obligation with reference to the nature Directives has been the designation of Natura 2000 sites which is administered by MS. The designation process has not been without problems and the many delays in site designation led the Commission to initiate actions before the Court and link certain Structural funds to site-designation to force MS to provide site-lists. In June 2008, most of the old EU MS had reached over 90 percent of their designation targets, however, with the entrance of 12 new members in 2004, the EU average on reaching the goals fell substantially.

[88] Forest Research (2010) Benefits of green infrastructure. DEFRA research contract number WC0807. October 2010.

Table B-1 State of progress by Member States in reaching sufficiency for the Habitat Directive Annex I habitats and Annex II species[89]



In terms of species and habitats, the "Health Check for Europe's protected nature" [90] and the EEA's "EU 2010 Biodiversity Policy Baseline: Post-2010 EU Biodiversity Policy" summarize the situation in Europe. The overall findings are that only a small proportion of the habitats and species looked at were in a favourable conservation state. Overall, only 17% of both habitats and species assessments were deemed favourable.

Conservation status	Favourable	Un-favourable	Unknown
Habitat types	17%	65%	18%
Species	17%	52%	31%

Source: EC (2010) *Health-check for Europe's protected nature*. Luxembourg: Publications Office of the European Union, 2010.

For habitats, some 65% were unfavourable and 18% unknown. Out of the 701 habitat assessments made, there were substantial variations across the different biogeographical regions. Dunes, bogs/mires/fens and grasslands were the habitat groups reported to have the worst conservation status. Rocky habitats such as scree slopes or caves have the best conservation status. A higher percentage of 'priority' habitats – those where the need for conservation has been identified as particularly high – were evaluated as in bad status, compared with non-priority habitats. This was most noticeable in coastal habitats. Meanwhile for species, 52% were assessed as unfavourable and 31% unknown. The latest EEA assessment (2010) also indicates that a large number of European species are still "threatened".

89 http://ec.europa.eu/environment/nature/natura2000/barometer/index_en.htm

90 EC (2010) *Health-check for Europe's protected nature*. Luxembourg: Publications Office of the European Union, 2010.

Marine mammals	25%
Amphibians	22%
Reptiles	21%
Dragonflies	16%
Terrestrial mammals	15%
Birds	12%
Butterflies	7%

Source: EC (2010) *Health-check for Europe's protected nature*. Luxembourg: Publications Office of the European Union, 2010.

Finally, extensive agriculture, wetlands and grasslands continue to decline in Europe. Between 1990 and 2006[91] Europe has witnessed:

- 5% decline in wetlands
- 2.6% decline in extensive agriculture
- 2.4% decline in natural grassland area
- 4.4% growth in waterbodies (artificial reservoirs)
- 7.9% increase in artificial surfaces
- 12% increase in transitional land (woodland degradation, forest regeneration and recolonisation)

It is clear that European biodiversity is declining on every front. Biodiversity loss also means losing the values and services provided by rich levels of species and habitats.

Environmental costs

Environmental benefits provided by Natura 2000 sites are for example: carbon sequestration, water retention and purification, and protection from erosion and avalanches.

Economic costs

Economic benefits from Natura 2000 are several. Tourism and recreation create jobs and support local business while fishing and hunting supports local markets. Additionally, Natura 2000 conserves habitats for more species than intended which in turn support pollinators and pest control in nearby agricultural production.

Several attempts have been made to estimate the economic benefits of Natura 2000 areas.

[91] EEA, 2010. EU 2010 Biodiversity Policy Baseline: Post-2010 EU Biodiversity Policy.

The gross benefits of the Natura 2000 network in the Netherlands was in 2006 estimated to around €4000 per ha/year, which at that point meant a total of €4.5 billion a year only in the Netherlands.[92] Key components included tourism, recreation and non-use benefits, and to a lesser extent the use of raw materials. Other studies use different methodologies and calculations. Three studies which included the direct and in-direct costs, and WTP and benefits generated from recreation, tourism and employment, all concluded that benefits are greater than costs for establishing and maintaining Natura 2000 areas. For example, in Scotland overall benefits were estimated to 7 times higher than costs. In Spain implementing the Natura 2000 network was calculated to have positive GDP impact ranging from 0.1-0.26%. Finally in France, benefits were also estimated to be 7 times higher than costs which were calculated to €142 per ha and year.[93]

Social impacts

Social benefits of Natura 2000 are often related to existence values such as recreation and education. Furthermore, walking trails and scenery create amenity values which are difficult to describe in monetary values

B.2.5 Invasive Alien Species

Gap assessment

Invasive Alien Species (IAS) are amongst the most potent threats to biodiversity. Whereas alien species (IS) are defined as "subspecies or lower taxon, introduced outside its natural past or present distribution…that might survive and subsequently reproduce", an *invasive* alien species is "an alien species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity".[94] Europe hosts more than 10,000 (known) IS from which 10-15% are expected to have negative ecological and/or economic impact, especially in marine eco-systems and isolated species-rich islands.[95]

- **Pathways for the introduction and establishment of invasive species have been controlled and established invasive species are identified, prioritised and controlled or eradicated.**

Environmental costs

The environmental costs of IAS are potentially incredibly high. Loss of native species, loss of genetic diversity and changes in ecosystems, are all possible impacts. Often IAS compete with native species with detrimental effects for the latter. The North American squirrel, for example, was introduced in the UK and

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92 Kuik, O., Brander, L. & Schaafsma, M. (2006) *Globale Batenraming van Natura 2000 gebieden*. 20 pp

93 Gantioler S., Rayment M., Bassi S., Kettunen M., McConville A., Landgrebe R., Ger des H., ten Brink P (2010) *Costs and Socio-Economic Benefits associated with the Natura 2000 Network.* Final report to the European Commission, DG Environment on Contract ENV.B.2/SER/2008/0038. Institute for European Environmental Policy / GHK / Ecologic, Brussels 2010

94 Decision VI/23* of the Conference of the Parties to the CBD, Annex, footnote to the Introduction

95 SEC(2008) 2887 and SEC(2008) 2886 'Towards an EU Strategy on Invasive Species

Italy. It is more effective in its hunt for resources which has brought the native squirrel to the brink of extinction.[96]

Economic costs

IAS also comes with huge economic costs. The North American Squirrel, for example, not only replaces the native inhabitant, but also poses a serious threat to hard timber production.[97] Timber, crops, marine resources, recreation and tourism are further economic sectors where IAS have an impact.

Social impacts

Some social impacts from IAS are already mentioned under the "economic costs" part, such as job losses in tourism and agriculture. However, a key concern is health impacts on people and livestock. Infectious disease agents are often IASs and outbreaks are normally tackled with large use of pesticides in the absence of natural enemies.[98] Furthermore, diseases such as foot and mouth disease are main reasons for early action against IAS.

B.2.6 Contribution to global biodiversity

Gap assessment

Contributing to global biodiversity takes a prominent part in the new vision and headline target. Currently, the EU is an important donor for biodiversity protection globally; however, average annual EU external assistance for biodiversity has remained largely unchanged since the adoption of the BAP in 2006. In the meantime, problems have continued to grow.

Early identification and measures to contain IASs are pivotal to address the problem effectively and cost-efficiently. Consequently, investing in monitoring and reporting of existing, new and potential IASs could avert many future biodiversity problems. This should be reflected in a sub-target for IASs. Such a sub-target could mirror an existing sub-target under the CBD:

- **% reduction of the biodiversity-related impacts of the EU footprint, to be achieved through the Resource Efficiency Initiative;**
- **% EU external budget earmarked for payments for biodiversity and ecosystem services;**
- **% EU climate change budget devoted to ecosystem-based adaptation and mitigation measures ("REDD+" model, with potential expansion to peatland and wetlands); and**

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96 Breummer et al (2000) *Impacts and Management of the Alien Eastern Gray Squirrel in Great Britain and Italy: Lessons for British Columbia*, L. M. Darling, editor. Proceedings of a Conference on the Biology and Management of Species and Habitats at Risk, Kamloops, B.C., 15 - 19 Feb., 1999. Volume One. B.C. Ministry of Environment, Lands and Parks, Victoria, B.C. and University College of the Cariboo, Kamloops, B.C. 490pp.

97 Ibid.

98 http://www.gisp.org/ecology/IAS.asp

- **% of Marine Protected Areas in areas beyond national jurisdiction.**

Environmental costs

The IUCN Red List 2008 analyses the status of 44.838 species all over the world. Of these of are 869 (2%) extinct or extinct the wild; 16,928 (38%) threatened with extinction (with 3,246 critically endangered, 4,770 endangered and 8,912 vulnerable); 3,513 (8%) are near threatened; while 5,570 (12%) have insufficient information to determine their threat status (data deficient).[99]

Economic costs

Currently €50 billion worth of ecosystem services is lost every year.[100] Other ongoing studies suggest that the actual value may be lower, but still be significant (perhaps around a half to a third of this figure, although this needs to be investigated further). These are incredibly large sums, and the repercussions for specific economic sectors vary substantially. For example, over exploitation of fisheries on a global scale is estimated to reduce income from the most commercially valuable fishing stocks with $50 billion annually.[101]

Social impacts

Social impacts of biodiversity loss are, as mentioned plenty. Job losses in tourism and recreation, health problems, recreational purposes, threats to livelihoods are among the most obvious ones.

B.3 Spillover effects

Key spillover effects of biodiversity loss are connected to food production, local economies, and pharmaceutical industry.

B.4 Key findings

Overview

The table below presents the key findings.

[99] IUCN (2008) State of the world's species.

[100] EC report (2008) *The Cost of Policy Inaction (COPI): The case of not meeting the 2010 biodiversity target.* Download from: http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/copi.zip

[101] TEEB (2010) Synthesis report.

Table B-2 Overview of nature and biodiversity sector costs of not implementing the legislation

Policy targets	Implementation gap	Costs associated with the implementation gap		
		Environmental costs	Economic costs	Social costs
Integration and sustainable use of resources	Losses in HNV farmland and old forests continue in Europe.	Loss of carbon sequestration, water regulation, pollination, and genetic diversity.	Loss of local economies, tourism.	Recreational values.
Overexploitation	70% of the EU's fish stock are being exploited beyond Maximum Sustainable Yield (MSY) levels	Collapse of aquatic ecosystems and extinction of marine species.	The key problem is either a collapse of fisheries, leading to job losses, or the lost opportunity costs of over-exploitation.	Recreational fishing.
Fragmentation and green infrastructure	Increasing fragmentation of ecosystems in EU	Damaging impact and/or unsustainable "island" ecosystems.	Loss of ecosystem services provided by biodiversity rich areas.	Loss of recreational areas, tourism, etc.
Nature conservation	Continued loss of species and habitats. Increasing number of threatened species. Designation of Natura 2000 sites not complete.	Loss of all carbon sequestration, water, nutrient, soil quality, pollination, etc	Loss in food-production, tourism, recreation, local economies, etc	Loss in recreational, amenity and educative values.
Invasive Alien Species	Continued spread of IAS	Detrimental effects on native species and ecosystems, by taking over resources, spread diseases and destroying habitats.	Large costs for agriculture, disease prevention and outbreak control.	Health problems such as allergies.

Policy targets	Implementation gap	Costs associated with the implementation gap		
		Environmental costs	Economic costs	Social costs
Contribution to global biodiversity	Continued high levels of biodiversity loss on a global scale.	Almost 40% of species are threatened of extinction.	Maybe up to €50 billion annually (estimates subject to further studies).	Major problems in health, job losses,

Implementation gaps

The implementation gaps in nature and biodiversity sectors manifests themselves in continuing decline in species and habitat levels all over Europe.

Costs of not implementing the acquis

The costs related to not realising the environmental benefits of nature and biodiversity legislation are related to loss in ecosystem services.

Appendix C Water

C.1 Introduction

The issue

Water is an essential element of all human, animal and plant life. At the same time, water is one of the key economic resources of our economies, primarily in relation to drinking water and water used in industry, agriculture and recreation. The increasing economic development of the EU Member States has increased the dependence on water resources and created more intensive pressures on them, in particular on the maintenance of their quality.

The key objective of the Europe's legal framework supporting water management is to aim to achieve good water status for all waters in Europe by 2015. This objective is to be reached through integrated management based on river basins. Integration is a key concept within Europe's water management system. It is recognised that in order to undertake river basin management effectively then multi-disciplinary approaches are needed.

Method and delineation

In the process of setting up river basin management plans, some Member State authorities have been engaged in estimating the costs and benefits of implementing measures required to reach the defined objectives by 2015, 2021 and 2027 respectively. These calculations would provide a basis for estimating lost benefits of not (fully) implementing water related policies.

The costs of inaction in the area of water pollution and abstraction are heterogeneous, and include a variety of use and non-use values[102]. Environmental degradation affects both ecosystem health and human health. Through its impacts on ecosystems, the costs can be related to use values (e.g. the effects of nitrates on agricultural productivity) or non-use values (e.g. the existence value of affected species habitats). The costs can be further distinguished between costs which are reflected in existing market "prices" for different goods and services (e.g. lost employee productivity, medical costs, increased raw water treatment costs) and those which are not reflected in market prices (e.g. health costs in terms of pain and suffering)[103].

The selected type of costs as a result of water pollution are increased drinking water treatment; reduced commercial fish stocks; reduced recreational opportunities, loss of biodiversity and adverse health impacts.

In order to illustrate the costs of not implementing water legislation, the remainder of this section focuses on the effects of polluted water sources on fisheries, recreation and food safety. The remainder of this section on water is devoted to this 'partial' analysis.

[102] For a discussion of use and non-use values see page 56

[103] OECD (2008), Environmental Outlook to 2030, Chapter 10

However, as will be seen, it is difficult to arrive at an overall estimate for missed benefits based on this approach and we therefore present another approach to arrive at this estimate as shown below.

Estimating the value of the WFD

In 2007, NERA Economic Consulting and Accent Market Research undertook a study for the UK Collaborative Research Programme into the Water Framework Directive (WFD)[104]. There, they used survey methods to estimate, in monetary terms, the value placed by households in England and Wales on improvements to the water environment brought about by the WFD. They used various elicitation methods to estimate the willingness to pay (wtp) of households to enjoy improvement towards a good quality status nationally by 2015 and beyond. For this study, DEFRA provided the researchers with the following scenarios of WFD implementation by key dates:

Scenario Name	Description
Maximum benefits	full improvement (100%) to High Quality achieved by 2015
Front loaded	50% of improvements by 2015, followed by 30% in 2021, and 20% in 2027
Even loaded	33% of improvements achieved by each of 2015, 2021, 2027
Back loaded	20% start in 2015 followed by a further 30% in 2021 and 50% in 2027
Less stringent objectives	25% by each of 2015, 2021, 2027, then no more (i.e. assumes less stringent ultimate objectives, amounting to the last 25% of improvement)
Nature assimilation lag	constraints from natural conditions, such as stocks of pollutants in sediment, mean that 50% of the improvement will not occur until 50+ years

Given that the target of WFD is full compliance by 2015, this is best scenario for estimation of the value of not implementing the legislation.

Based on this scenario, the study has estimated that the wtp per household is between 45 and 168 GBP per household (or 24 to 89 GBP per person per year).[105] Using Eurostat data to arrive at EU wide figures, we estimate that the **total value is between 12 and 44 billion EUR**.[106]

C.1.1 Compliance gap

The overall aim of European water legislation combined with other pieces of legislation, such as the Drinking Water Directive (DWD), the Urban Waste water and Treatment Directive (UWWTD), the Nitrates Directive and the Bathing Water Directive (BWD), is to deliver (see Table C-1):

[104] Report on The Benefits of Water Framework Directive Programmes of Measures in England and Wales, Nera & Accent, November 2007

[105] The average household size in the sample is 2.6.

[106] Taking the UK as a base (=100), the purchasing power parity (ppp) of the EU27 is 98 and the EU population is just below 500 million inhabitants.

- good ecological status for all water bodies by 2015 (combing good water quality and protection of the marine environment);
- sound health protection; and
- prevention of flooding ("disaster prevention" - reduction of risks of flooding/effects of flooding)

This translates into the following sub-goals:

- Preventing deterioration and protecting and enhancing the status of water resources.
- Promoting sustainable water use based on long-term protection of water resources.
- Protecting and improving the aquatic environment through specific measures for reducing and phasing out discharges and emissions of hazardous substances.
- Reducing and preventing further pollution of groundwater.
- Contributing to mitigation of the effects of floods and droughts.

These individual goals give us the tools to analyse the economic impact of not implementing the environmental acquis in the water sector.

Table C-1 Policy targets and associated indicators related to water

Directive	Contents in focus here	Possible compliance indicators
Water Framework Directive (2000/60/EC)	Good ecological status by 2015	Ecological status has been defined in terms of biological, physico-chemical and hydro-morphological indicators. The values for these indicators for different water bodies have been determined though a so-called intercalibration process.
Drinking Water Directive (98/83/EC) (80/778/EEC repealed 25/12/2003)	Quality of drinking water for human health	Measurement in microbiological and chemical parameters available from the EU Circa website. Most MS in compliance with regard to larger water supplies
The Urban Wastewater Treatment Directive (91/271/EEC)	Collection, treatment and discharge of domestic and certain industrial waste waters.	Type of treatment plant (capacity per population equivalent). Four Implementation Reports have been published by the COM. Information provided by the MS is in many cases comprehensive, in several cases at least partly incomplete. Most Old Member States in compliance - several southern European MS not in compliance - new MS has time derogations
Nitrates Directive (91/676/EEC)	Reduce water pollution caused by nitrates from agricultural sources	National monitoring and reporting every 4 years on nitrates concentrations and eutrophication. Varying degree of compliance - most MS are formally in compliance though the effect on total nitrogen loads might be insufficient to reach good water quality.
Bathing water directive (2006/7/EC) (76/160/EEC repealed)	Human health.	Compliance with guide values. Values are defined in the Annex to the Bathing Water Directive for the parameters 'faecal streptococci' and 'faecal coliforms'.
Directive 2007/60/EC on the assessment and management of flood risks (2007)	Protect assets and humans at risk from flooding in areas near water courses and coast lines	Preliminary flood risk assessment of river basins and associated coastal zones by 2011 to identify areas where potential significant flood risk exists. Where real risks of flood damage exist flood hazard maps and flood risk maps for such areas should be available by 2013 and flood risk management plans by 2015

Integration is a key concept within Europe's water management system. It is recognised that in order to undertake river basin management effectively then multi-disciplinary approaches are needed. Integration principles are adapted as outlined below:

- Integration of environmental objectives.
- Integration of all water resources at the river basin scale.
- Integration of all water uses, functions and values into a common policy framework.

- Integration of disciplines, analyses and expertise to assess current pressures and impacts on water resources and identify measures for achieving the environmental objectives of the Directive in the most cost-effective manner.

- Integration of water legislation into a common and coherent framework.

- Integration of all significant management and ecological aspects relevant to sustainable river basin planning.

- Integration of a wide range of measures in a common management approach. Programmes of measures are defined in River Basin Management Plans developed for each river basin district.

- Integration of stakeholders and the civil society in decision making in the development of river basin management plans.

- Integration of different decision-making levels that influence water resources and water status for an effective management of all waters.

- Integration of water management from different Member States for river basins shared by several countries.

Table 6.1 above lists the main Directives and mentions the key targets and elements of each Directive which allows for quantifications.

For this analysis we concentrate on the gap in implementation of the WFD (good ecological status) and the flood directive . Thus, while specific directives can be related to specific aims, there are other directives whose relation is more indirect. For example, the Urban Waste Water Directive and the Nitrates Directive are directives that both aim to protect water quality - and hence to deliver compliance with regards to these overall objectives.

Contributing to a better ecological condition of fresh water bodies is the core objective of the Water Framework Directive. Gaps can be assessed for this directive, but only in relative terms. The EEA, in the framework of its flagship product “European Environment State and Outlook Report 2010” (SEOR 2010) discusses a number of policy questions related to water quality. Under the heading of “are concentrations of nutrients in our freshwaters decreasing” the key messages are:

– Nitrate concentrations in Europe's ground waters increased in the first half of 1990s and have then remained relatively constant;

– The average nitrate concentration in European rivers has decreased approximately 10 % since 1998 from 2.8 to 2.5 mg N/l, reflecting the effect of measures to reduce agricultural inputs of nitrate;

– Nitrate levels in lakes are in general much lower than in rivers, but also in lakes there has been a 15 % reduction in the average nitrate concentration;

– Phosphorus concentrations in European rivers and lakes generally decreased during the last 14 years, reflecting the general improvement in wastewater treatment and reduced phosphate content of detergents over this period.

It is clear that the overall effect of these improvements are significant, both in terms of environmental as well as social and economic impacts. However, there have been few attempts to estimate the monetary value of these efforts. In 2005, the Commission initiated studies to estimate the costs and benefits of the implementation of the WFD, and in 2006 it commissioned an exploratory cost-benefit analysis to look at the work that had been carried out on Member State level, the available methodologies and examples, in particular in relation with agriculture. However, the study has not been finalised but some preliminary conclusions have been published. These are[107]:

– More than 150 relevant studies have been compiled and another 25 studies were identified which are currently in progress. However, most of them only cover a very particular aspect on either costs or benefits. Only few comprehensive cost-benefit studies on water management are available;

– Only three Member States (the United Kingdom, the Netherlands and France) have carried out more comprehensive national work of costs and benefits of the WFD implementation. Some are currently working on the issue or intending to do so at a later stage and for six Member States there appears to be no information available at all. Only two Member State have looked at the administrative costs associated with the WFD implementation;

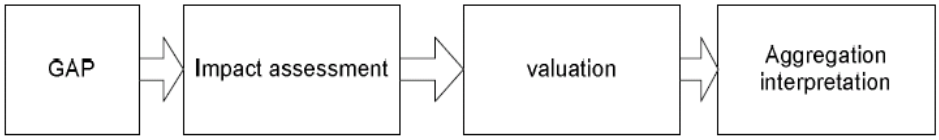
– There are many methodological difficulties and data gaps, in particularly on the benefit side that prevent the preparation of a pan-European cost-benefit analysis. Furthermore, it is difficult to carry out a full cost-benefit analysis since the costs of implementation will depend on the level of ambition of the programme of measures which will only be known in 2009 following the finalisation of the river basin management plans;

– Another complication is the difficulty in estimating the economic baseline as regards the costs of implementation of other policies (for instance the UWWT or Nitrates Directive) and to estimate exactly how much implementation of such policies in the pipeline will contribute to the achievement of the environmental objectives of the WFD;

– Common methodologies and related data needs are lacking and should be developed and applied on EU level.

The basic approach to valuating the observed gaps follows the WFD guidelines. The figure below shows the steps involved.

[107] Source: Commission Staff Working Document 'Towards Sustainable Water Management in the European Union', COM(2007) 128 final.



For some countries or river basins valuation studies have been carried out (see overview below) and our study can be based on these 'partial' analyses.

Figure C-1 Studies either finished or ongoing according to a 2007 study[108]

Member State°	Source of information	Nation-wide estimates WFD First exercises			Case studies/Specific measures		
		CBA	Costs	Benefits	CBA	Costs	Benefits
Austria	x*					X	X
Belgium	X				X	X	X
Bulgaria							
Cyprus	x**						X
Czech Rep.	x*						
Denmark	X						X
Estonia	x*						
Finland	X				X		
France	X		X	X	X	X	X
Germany	X				X	X	X
Greece	x**					X	X
Hungary	X				X	X	X
Ireland	x*					X	X
Italy	x**						
Latvia	x**					X	
Lithuania	x*						
Luxembourg	x**						
Netherlands	X	X	X	X	X	X	X
Malta	X					X	
Poland	x*						
Portugal	X					X	
Romania	x**					X	
Slovak Rep.	X						X
Slovenia	X						
Spain	X				X	X	X
Sweden	X				X	X	X
UK	X	X	X	X	X	X	X
Norway	*x**						

Information provided: X = based on questionnaire, x* = information gathered via workshop or via other source (x**)

[108] *Nocker. L.E, S. Broekx, I.Liekens, B. Görlach, J. Jantzen, P. Campling (2007) Costs and Benefits associated with the implementation of the Water Framework Directive, with a special focus on agriculture. VITO, Ecologic and TME. Study for DG Environment EC 2007*

C.2 Implementation gaps and cost of non-compliance

C.2.1 Good ecological status

WFD

Gap assessment

Contributing to a better ecological condition of fresh water bodies is the core objective of the Water Framework Directive. Gaps can be assessed for this directive, but only in relative terms. The EEA, in the framework of its flagship product "European Environment State and Outlook Report 2010" (SEOR 2010) discusses a number of policy questions related to water quality. Under the heading "are concentrations of nutrients in our freshwaters decreasing" the key messages are:

– Nitrate concentrations in Europe's ground waters increased in the first half of 1990s and have then remained relatively constant;

– The average nitrate concentration in European rivers has decreased approximately 10 % since 1998 from 2.8 to 2.5 mg N/l, reflecting the effect of measures to reduce agricultural inputs of nitrate;

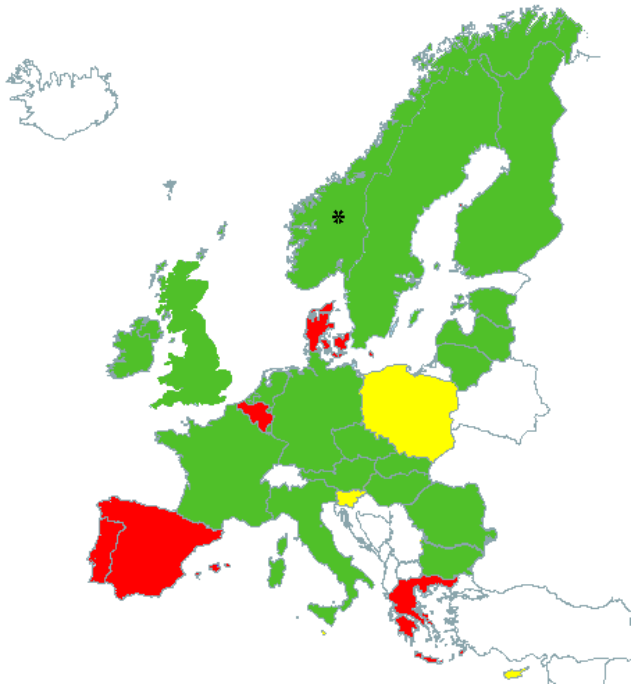
– Nitrate levels in lakes are in general much lower than in rivers, but also in lakes there has been a 15 % reduction in the average nitrate concentration;

– Phosphorus concentrations in European rivers and lakes generally decreased during the last 14 years, reflecting the general improvement in wastewater treatment and reduced phosphate content of detergents over this period.

Year	Issue	Reference
2000	Directive entered into force	Art. 25
2003	Transposition in national legislation Identification of River Basin Districts and Authorities	Art. 23 Art. 3
2004	Characterisation of river basin: pressures, impacts and economic analysis	Art. 5
2006	Establishment of monitoring network Start public consultation (at the latest)	Art. 8 Art. 14
2008	Present draft river basin management plan	Art. 13
2009	Finalise river basin management plan including programme of measures	Art. 13 & 11
2010	Introduce pricing policies	Art. 9
2012	Make operational programmes of measures	Art. 11
2015	Meet environmental objectives First management cycle ends Second river basin management plan & first flood risk management plan.	Art. 4
2021	Second management cycle ends	Art. 4 & 13
2027	Third management cycle ends, final deadline for meeting objectives	Art. 4 & 13

The deadline for reporting the River Basin Management Plans to the Commission (22.3.2010) have expired, and by the end of 20101 river basin management plans have been adopted by a majority of Member States. However, the European Commission is urging seven remaining states to comply with the legislation and submit their plans. Member States concerned include Belgium, Cyprus, Denmark, Greece, Malta, Portugal and Slovenia. (see Figure C.2)

Figure C-2: implementation status of RBMP



Green River Basin Management Plans adopted.

Yellow consultations finalised, but awaiting adoption.

RED consultations have not started or ongoing.

Source: European Commission - Updated 07/02/2011

As of yet, there has not been an analysis at EU level of the gaps in WFD implementation, and our analysis will therefore focus on individual Member States.

For Austria, it is expected that by 2015, 42 percent of the rivers will have reached a status that is described as good or very good, and this share is to rise to 50 percent by 2021 and 100 percent by 2027. Other countries show similar results, however, only very few of the national River Basin Plans provide information on this level.

Environmental, economic and social costs

To estimate the environmental cost of not implementing the 'water acquis' requires first a definition of the type of benefits likely to accrue from improving the ecological status of water bodies. Based on the recent UN study [109] four categories of ecological services can be distinguished:

[109] Millennium Ecosystem Assessment (2003) Ecosystems and human well-being: A framework for assessment, Island Press, Washington, D.C.

- Provisioning services where products can be obtained from ecosystems. In the context of the WFD, examples include (i) water for industrial or agricultural use; food (commercial fish catch); and (iii) renewable energy (e.g. hydro power or tidal power).

- Regulating services: these refer to the benefits obtained from the regulation of ecosystem processes. In the context of the WFD, examples of regulating services include: (i) water regulation (flood prevention and aquifer recharge.); ii) water purification and waste management (filtration of water, detoxification of water and sediment or purify water and/or sediment);

- Cultural services which refer to the non-material benefits that individuals obtain from ecosystems. In the context of the WFD, examples of cultural services include: i) recreation and tourism (activities that individuals do for enjoyment and business activity connected with providing accommodation, services and entertainment for people who are visiting a place for pleasure (e.g. angling, boating, swimming, etc.); ii) aesthetic (amenity values); iii) education (using rivers/lakes/canals etc. as an aid to teaching) and iv) supporting services which refer to services that are necessary for the production of all other ecosystem services (their impacts on people are either indirect (via provisioning, regulating or cultural services) or occur over a very long time)

It will be clear that many of the (cost and) benefits related to the services defined above will be difficult to estimate. One such effort has been made in a Dutch study for which the results are shown below:[110]

[110] Kwaliteit voor later Ex ante evaluatie Kaderrichtlijn Water (*Quality for Later, ex-ante evaluation of the WFD),* Planbureau voor de Leefomgeving (PBL), 2008

Table C-2 Benefit of Water Framework Directive - estimates for the Netherlands

Benefit category	Effect	Estimated benefit (€m)	Remarks
Economic benefits			
Drinking water from surface or groundwater sources	Not implementing additional steps for abstracting 'problem substances'	p.m	
Cost savings with water use agriculture	Use of groundwater instead of tap water for animals, reduction in the need for irrigation	--	
Cost saving for industry	Use of groundwater instead of rain water	--	Many industries have already reduced the use of tap water, further reductions not likely
Health of swimmers	Reduction blue algae, etc.	2-17	Great uncertainty
Food security	Less risk for infections	p.m.	Is mostly related to point sources (chemical regulations)
Recreation and recreational experience	Additional recreational visits to areas bordering open waters	254-873	Mostly substation, uncertainties in establishing shadow price
Sports fishing possibilities	Additional fishing days	p.m.	Already included in recreation
Reduced number of swimming accidents	Better visibility	p.m.	Already included in recreation
Increased satisfaction housing	More natural borders, better visibility	704-2309	Significant positive effect on housing prices
Environmental benefits			
Protection climate by nature friendly river borders and public health	Fixation of greenhouse gas, health effects by capturing of NOx en SO2	554-1818	Net effect of capturing greenhouse gas may be close to zero; the effect of capturing air pollution by tress and shrubs is uncertain and likely to be marginal
Non-use value of biodiversity	Effects on morphology/ phytoplankton	265-869	

UWWTD

Gap assessment

One of the most important factors determining the quality of water is the manner in which wastewater is treated before it is discharged in our rivers, lakes and seas.

The collection, treatment and discharge of domestic water is being monitored on a regular basis and according to the 5th Commission Summary on the Implementation of the Urban Waste Water Treatment Directive (UWWTD) published in the 2009. Collecting systems in the EU18 are in place for 93% of the total pollution load, and secondary treatment is in place for 87% of the load and more stringent treatment is in place for 72% of the load. The secondary and

more stringent treatment which is in place reached the required reduction levels for only approximately 90% of the load.

The most important gap in terms pollution and water quality is likely to be the missing 37% of the load that requires stringent treatment where it is not yet installed. For most of this load, the relevant Member States have time derogations. About 14% of the load that requires stringent treatment was in no-compliance based on the most recent data[111].

Environmental costs

The impact of untreated waste water on the ecology of inland water and marine resources is well documented and remains a concern for many sensitive areas within the boundary of the EU.

Economic costs

There could be direct economic gains from improving the treatment of urban waste water if downstream water is used for recreational purposes or water abstraction. The estimated benefits can be substantial in the case of recreation (the downstream area is avoided by bathers, boaters perhaps even anglers), but will be modest in the case of water extraction, as additional investments in water filters by water companies (or other large consumers of water) will be minimal.

Social costs

Following the same line of reasoning, the social cost of not treating urban waste water can be substantial, as employment in the tourism sector for the affected area will be less than otherwise. There could also be direct employment associated with the treatment of urban waste water.

The effects described above will be more pronounced in the new Members States compared to the older MS.

Nitrates Directive

Gap assessment

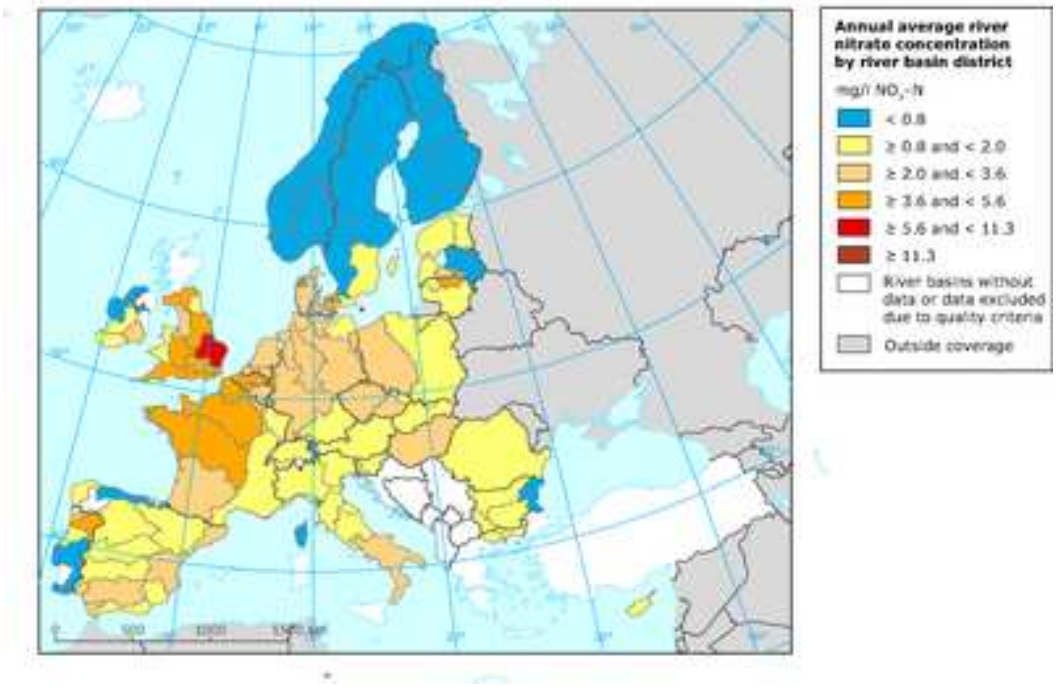
Agriculture is the largest contributor of nitrogen pollution, and due to the EU Nitrate Directive and national measures the nitrogen pollution from agriculture has been reduced in some regions during the last 10-15 years. This reduced pressure is reflected in a significant decrease in river nitrate concentrations at 29% of the river stations throughout the EU, while there has been a significant increase at 16% of the stations. The countries with the highest proportions of river stations with significant decreasing trends are Denmark, the Netherlands, Czech Republic and Germany. Across Europe as a whole, the rate of improvement is still slow, reflecting the continued significance of agricultural nitrogen emissions.

Rivers draining land with intense agriculture or high population density generally have the highest nitrate concentrations. Rivers with nitrate concentrations exceeding 5.6 mg/l N are found predominantly in northwest France, Spain, Belgium and the southeast UK. However, several rivers with concentrations exceeding 3.6 mg/l N are found in many other countries, particularly in the Netherlands, Denmark, Germany, Austria, Ireland, Hungary, Italy, Estonia and

[111] COWI 2010 *Compliance costs of the Urban Wastewater Directive* (unpublished document.)

Latvia. Rivers in the more sparsely populated Northern Europe and mountainous regions generally have average concentrations less than 0.8 mg/l N (see Figure C.3 below).

Figure C-3 Annual average river nitrate concentration by basin district (2008)



Costs

Reducing the nutrient content of effluents generates environmental benefits and contributes to reducing the animal and effluents gas emissions. The overall costs in terms of not realised environmental benefits are an important part of the costs that accrue from not attaining an improved ecological status of water bodies throughout the EU.

C.2.2 Sound health protection

Drinking Water Directive

Gap assessment

The status of drinking water quality in the EU is reported to the European Commission in three year cycles. Synthesis reports (up to 2004) are available. There are also other data sources that provide data on the number of people with access to (save) drinking water. These can be used to assess the number of people in the EU that do (not yet) have access to save drinking water and who are therefore liable to diseases.

The table below presents key data on the supply of drinking water in the EU: the total population in the Member States and the percentage of this population served in the large water supply zones. Where available, these figures will be updated.

Table C-3 Information on the supply of drinking water in the European Union

MS	Population in millions	% of the total population served by these supply zones
B	10.3	83-100
CZ	10.2	72
DK	5.4	65
D	82.5	72
EE	1.35	64
EL	10.6	??
ES	43.2	70
F	60.1	73
IRL	3.9	68-73
IT	57.4	81-83
LUX	0.45	??
NL	16	100
AT	8.17	65-67
PT	10.5	84
FIN	5.2	73
S	8.8	??
UK	60	89

Source: Synthesis report on the quality of drinking water in the Member States of the EU in the period 2002-2004.

To analyse the gap we need data on compliance and non-compliance of the Member States (more than 1% non-compliance in all samples taken in the various Member States), with the parameters given in the 98/83/EC DWD. Table 6-4 gives an overview of the 17 Member States that show non-compliance for the 98/83/EC parameters in more than 1% of the samples taken in the various Member States. The table shows that Italy has the highest number of parameters that have non-compliance, while the Netherlands has none.

Table C-4 Non-compliant parameters DWD 98/83/EC in 17 EU MS (2002-2004)

MS	B	CZ	D	DK	EE	EL	ES	F	IRL	IT	LUX	NL	AT	PT	FIN	S	UK	TOTAL
LIST A PARAMETERS																		
E.coli										X			X					2
Enterococci		X	X				X	X		X			X	X				7
LIST B PARAMETERS																		
Antimony										X								1
Arsenic				X			X	X		X			X					5
Benzene																		0
BaP		X		X											X			3
Boron										X								1
Bromate																		0
Cadmium																		0
Chromium																		0
Copper				X														1
Cyanide										X								1
1,,2-dichloroethene		X								X								2
Fluoride								X		X					X			3
Lead	X			X				X									X	4
Mercury		X								X								2
Nickel	X							X		X			X					4
Nitrate		X		X			X	X		X								5
Nitrite				X						X								2
Total pesticides		X	X															2
Individual pesticides								X					X		X		X	4
PAH	X							X		X							X	4
Selenium								X										1
Tri and tetrachloroethylene		X								X					X			3
THM		X	X		X			X		X							X	6
VinylChloride		X																1
	3	9	3	6	1	N.I.	3	10	0	15	0	0	5	1	4	N.I.	4	

Environmental costs

Experience gained with risk-based approach to the treatment and distribution of drinking water lead to the insight that drinking water safety must be ensured from the source via treatment, storage and distribution up to and including the tap of the consumer. Therefore, the ecological status of water bodies from which drinking water is extracted is improving. However, no studies have been identified to calculate the benefits from these improvements.

Environmental benefits of shifting from bottled water to tap water: the provision of water by underground pipes is energy-efficient and consumes far fewer natural resources per unit of water than using bottled water. Placing water in bottles and transporting these around the country (or around the globe) consumes far more energy and other resources than using tap water. The manufacture of bottles also can cause release of phthalates, and other by-products of plastic-making, into water, air, or other parts of the environment. And, ultimately, many bottles will be added to already overflowing landfills or incinerated, potentially adding to our environmental problems.

Economic costs

The economic cost of not fulfilling the requirements of save drinking water relate to increased incidences of morbidity and mortality. A 2001 study by Ecotec estimated the value of benefits accruing from the acquis for the (then) candidate countries.

Illustrative examples of potential gains of cleaner drinking water will be provided. In addition, there will be savings in terms of shifting consumption from bottled water to tap water. Bottled water typically costs hundreds of times more than tap water.

Table C-5 Benefits of full compliance with Drinking water regulation

Country	*Annual benefits*		*Present value**	
	Low	*High*	*Low*	*High*
Bulgaria	160	435	160	435
Cyprus	25	100	25	100
Czech Republic	1560	2475	1560	2475
Estonia	27	100	27	100
Hungary	280	1080	280	1080
Latvia	40	140	40	140
Lithuania	125	280	125	280
Malta	13	47	13	47
Poland	1400	3280	1400	3280
Romania	405	1250	405	1250
Slovakia	305	680	305	680
Slovenia	150	350	150	350

* net present value of total benefits over period 2000-2020, assuming full implementation at 2010 and at 4% discount rate
Source: Ecotec, 2001

Social costs

Social benefits in terms of increased employment may accrue from providing areas with safe drinking. No studies in this area have yet been identified. There is also a public health concern related to the use of bottled water. Bottled water sometimes poses its own potential health risks due to contamination.

Text box C-1 Compliance with Drinking Water Directive[112]

Extra costs of accelerated compliance investments

In Italy a large number of smaller water supplies use ground water with too high levels of number substances for example arsenic. The concentrations of these substances exceed the DWD requirements. The Directive allows for time derogations and Italy have given derogations to these water suppliers. Such time derogation can be granted up to three times but the third time the Commission has to approve. Italy now faces a situation where they might not be allowed to give derogations for the third time. Many of the small water supplies would be able to get water from different source by connecting to larger neighbouring water supplies. This would be the cheapest solution but it will take longer time to implement. Many small supplies are now facing a situation where they have to invest in relatively expensive water treatment equipment which they will use on temporary basis until they can be connected to the larger systems. This is an example of how the compliance costs can be higher if the implementation suddenly has to be accelerated. Due to institutional constrains it has been difficult and slow process of getting the small supplies to take the necessary actions.

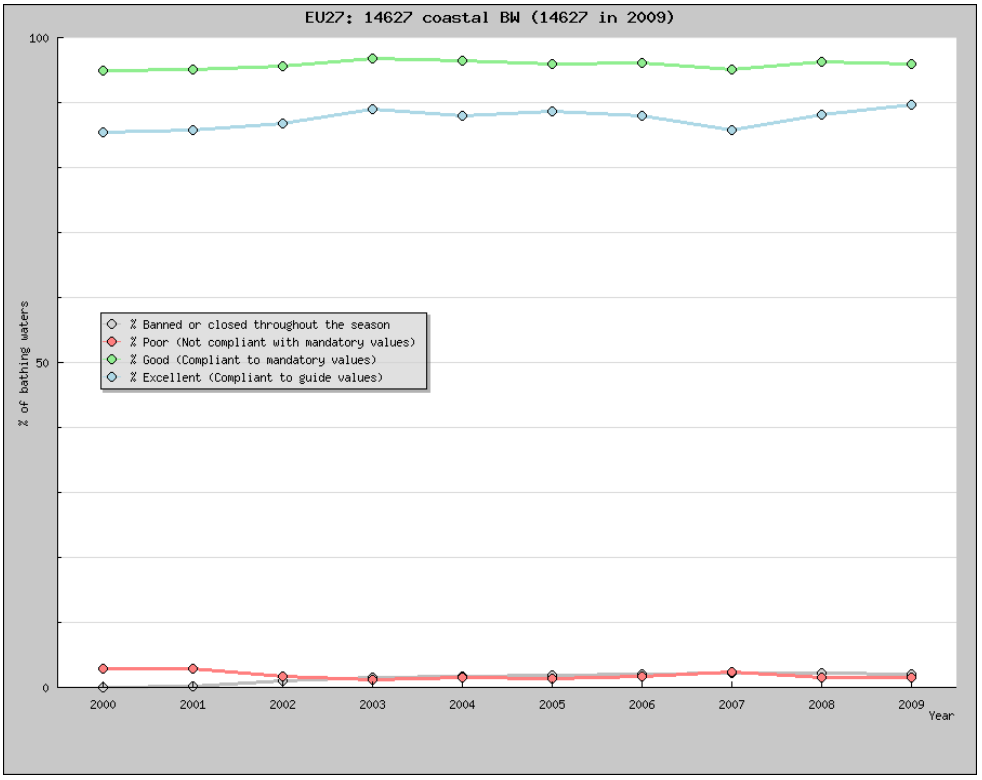
[112] COWI 2011 - Study on compliance with the Drinking Water Directive

Bathing water directive

Gap assessment

The Directive 2006/7/EC concerning the management of bathing water quality (repealing Directive 76/160/EEC.European legislation) was transposed into national law in 2008 and Member States have until December 2014 to implement it.

Under this Directive, Member States are required to ensure as a minimum that bathing waters meet the 'mandatory' microbiological water quality standards and must also endeavour to ensure that bathing waters meet the more stringent 'guideline' standards. The "WISE Bathing Water Quality data viewer" provides a quick check on the quality of coastal and freshwater bathing waters. Below we present a graph with the percentage of bathing areas with four different quality levels. Although there are many regional variations, the overall picture that emerges form this graph is that the situation regarding the quality of bathing water for the whole of the EU has been fairly stable over the last 10 years.



According to the latest report by EEA on the quality of EU bathing waters[113], compliance of coastal bathing areas with mandatory water quality values is lower on average on the Mediterranean coasts (94.9 %) than in the rest of EU regions where the compliance is above 95.9 %. For inland bathing areas, the Black Sea, North Sea, Atlantic and Baltic Sea do best compared to the mandatory values, while the first three also do well with the more stringent criteria. The inland bathing areas of the Mediterranean fall below the European average in complying with the mandatory values.

[113] EEA report No 3/2010: Quality of bathing water — 2009 bathing season

It is important to realise that safety of bathing water is tightly linked to sanitation and wastewater treatment: allowing contaminants to enter fresh water or the sea increases exposure by bathers and causes disease outbreaks. Children are at higher risk than adults, because they play for longer periods in recreational waters, are more likely to swallow water and may lack immunity to endemic diseases.

Costs

Exposure to contaminated bathing water can affect human health. According to the WHO Regional Office for Europe, data on the public health impact of contaminated bathing water in the European Region are scarce[114]: only nine countries have monitoring systems that record outbreaks from bathing water. Data from these countries indicate that outbreaks from bathing water are rare, causing a total of 4 to14 outbreaks annually between them. The low disease burden from recreational water may be related to the known improvements in EU bathing water quality, as well as to the significant limitations of routine country surveillance. Furthermore, it is still difficult to attribute illnesses to exposure in recreational water owing to the large number of other transmission routes of the pathogens.

C.2.3 Flooding

Flood Directive

Gap assessment

The Flood Directive (2007/60/EC) requires that all EU Member States develop flood hazard and risk maps by 2013. Using hazard maps, this planning aims to limit increases in potential damage, to avoid aggravating it in risk areas, and even to reduce it in the longer term. The various stages in the process leading up to the reporting deadline of the Flood Risk Management Plans (March 2016) are:

- Notification transposition (November 2009); all MS have complied.
- Competent authorities /Units of management (May 2010)
- Preliminary Flood Risk Assessment (March 2012)
- Flood Hazard & Flood Risk Maps (March 2014)

At this stage, there are therefore no delays in implementation of the Flood Directive.

Economic costs

The main economic benefits that will be missed when Member States are not complying with the Flood directive have been identified as reduced economic growth. The impact assessment carried out in preparation of the Flood Directive quoted one case where avoided losses were calculated[115]: €64 million in relation to flood protection measures in the Engelberger Aa region in Switzer-

[114] WHO 2010. Health and Environment in Europe: Progress Assessment
[115] COM(2006) 15 final

land. In the Netherlands, where regular flooding of the Meuse had caused economic damages to housing areas, flood prevention measures taken in 1994 increased the value of the private properties (positive wealth effects) and also decreased losses of the economic actors in the affected areas. The Impact Assessment estimates that for the Rhine area, some €40 billion are potentially missed when flood risk measures are not implemented. Examples of costs categories that are like to figure in flood risk estimates are:

- number of residential properties flooded;
- number and type of commercial properties flooded ;
- number of weeks that people have to move out of their property while it is being repaired;
- area of land (agricultural and environmental) affected by landslides and/or flooding;
- costs of emergency repairs to flood defence structures and number/type of flood events;
- length of diversions following landslides/road closures due to flooding;
- time over which disruption to train services was experienced, particularly for major lines.

Environmental costs

Environmental costs can occur when flood measures have a negative effect on the ecological status of water bodies. However, since the two Directives are closely link, this risk has been reduced. In case measures are not taken or postponed, economic activities continue to be at risk since flood maps indicating risk areas would not be available to guide these activities.

Social costs

Not implementing flood measures will continue to cause health related risks (psychological distress) and the labour market will not benefit from improved functioning in the flood prone areas.

C.3 Spillover effects

C.3.1 Good ecological status

In relation to attaining good ecological status additional costs or benefits are being accrued in other policy areas. The following cases serve as examples:

- Measures that result in lower production from hydro-electric plants. The value of marginal losses in hydropower production depends on the market for electricity, and if 1 kWh of hydro is lost, it will have to be produced using different sources. For this loss, both internal and external environmental costs are relevant, especially since hydro has low external costs for CO2 and air pollution per kWh.

- Measures to reduce water scarcity will relieve climate change problems. In many regions, adaptation to climate change will be closely linked with adaptation to water scarcity. Measures that reduce water consumption and increase efficiency will be essential elements of adaptation strategies in these cases, and will often be robust in the sense that they will bring benefits independent of the magnitude of the changes.

- Increased wastewater treatment will use more energy.

- Measures to improve water quality (e.g. wetlands) will have positive slip-over on biodiversity/nature.

C.3.2 Health

In relation to sound health protection, providing wider coverage of tap water to private homes will reduce the pressure on the environment by reducing the amount of used plastic bottles and relief pressure on roads and transport in general (less bottles to be delivered).

C.3.3 Flooding

The close linkages between the WFD and Flood Directive would ensure not only that flood-related measures will not have a negative effect on the ecological status of water bodies, but can result in measures that contribute to the ecological status.

C.4 Findings

The key results of the analysis of the water sector are about current implementation gaps and the costs associated with these gaps. The table below provides an overview of the key results.

Table C-6 Overview of costs for the water sector

Policy goals	Implementation gap	Costs associated with the implementation gap		
		Environmental	Economic	Social
Good ecological status of water bodies	The average nitrate concentration in European rivers has decreased approximately 10 % since 1998 from 2.8 to 2.5 mg N/l. Nitrate levels in lakes are in general much lower than in rivers, but also in lakes there has been a 15 % reduction in the average nitrate concentration. Phosphorus concentrations in European rivers and lakes decreased during the last 14 years. Collecting systems for waste water in EU18 are in place for 93% of the total pollution load, the secondary treatment is in place for 87% of the load and more stringent treatment is in place for 72% of the load.	The ecological status of water bodies is improving but no studies have been identified to calculate the benefits from these improvements. The impact of untreated waste water on the ecology of inland water and marine resources remains a concern for many sensitive areas within the boundary of the EU.	Economic gains from improving the treatment of urban waste water if downstream water is used for recreational purposes or water abstraction.	Not treating urban waste water may effect employment in the tourism sector.

Policy goals	Implementation gap	Costs associated with the implementation gap		
		Environmental	Economic	Social
Improved status of health	Compliance information on the Drinking Water Directive shows that Italy has the highest number (15) of parameters that have non-compliance, followed by France (10) Compliance with mandatory values of clean bathing water increased over the 1990 to 2008 period from 80% to 96% and from 52% to 92% in coastal and inland waters respectively.	Similar to above	The economic cost of not fulfilling the requirements of save drinking water relate to increased incidences of morbidity and mortality. Calculations of the benefits derived from less health related problems in bathing water can be made if sufficient data can be found.	Social benefits in terms of increased employment may accrue from providing areas with safe drinking. No studies in this area have yet been identified.

Policy goals	Implementation gap	Costs associated with the implementation gap		
		Environmental	Economic	Social
Reduced flooding		The negative consequences of flooding on the environment is decreased	Potential damages may be reduced in some regions (there should be coordination for this benefit to extend to multiple regions). Positive impact on the competitive position of EU industry as EU industries would be less affected or disturbed by flood events, in terms both of frequency and impact.	Reduced risk of loosing jobs, e.g. in SMEs in the medium and long term, when floods are properly managed. Decrease in the likelihood of health risks related to flood events, e.g. psychological distress. Positive impact on the functioning of the labour market, as companies and industries are less affected or disturbed by flood events.

Implementation gaps

The implementation gaps in the water sector are still significant, but time-paths have been set and derogations (to 2015, 2021 and 2027) agreed.

Costs of not implementing the acquis

There are a few sources that have estimated the WTP of the population for improved water quality as required by the WFD. Earlier in this section, a detailed UK study was described and addition to that source, the project Aquamoney[116] provides a number of case studies from select EU river basins.

Based on these studies, an overall estimation of the benefits of the 2015 WFD targets can be compiled.

[116] Aquamoney Various final case study reports from the project.

Table C-7 Value of Good ecological status - WFD objective by 2015

Study	Type of estimate	Mean WTP EUR per person/year	Total EU27 estimate million EUR per year
UK (NERA)	Low estimate	24	11,724
	High estimate	89	43,769
Lithuania	Mean	6	5,164
France	Mean	20	8,929
Spain	Good ecological status	24	12,744
	Very good ecological status GES	37	19,912

Source: NERA 2007 and Aquamoney (various case studies)

There are many reservations to these results limited the robust when using them to up-scale to an EU27 wide estimate. WTP estimates are affected by many factors - socio-economic characteristics of the respondents, their level of information and understanding the issue and the starting level of water body quality.

The WTP based value of the WFD improvements to be achieved by 2105 can be described by applying the following range: 5 - 20 billion EUR per year.

Appendix D Air

D.1 Key legislative framework

Bearing in mind that this study is about assessing the compliance gap and analysing the costs (in terms of missed gross benefits) of non-compliance, the key EU legislation in the field of air is the legislation that relates to the overall environmental and health targets. More specifically, this includes:

- The Communication on Thematic Strategy on Air Pollution (COM (2005) 446
- The Directive on "Ambient Air Quality and Cleaner Air for Europe" (Directive 2008/50/EC)
- The Directive on "National Emission Ceilings for certain atmospheric pollutants" (NECD) (Directive 2001/81/EC)

A number of sector specific pieces of legislation are in place that support the achievement of the targets set in the Thematic Strategy and the non-exceedances of the ceilings established under the NECD. These include for example the IPPC Directive, the LCP Directive, the Solvent Emission Directive and the regulations and directives that set standards for vehicle fuels and vehicles (norms).

Still, however, keeping the above objective in mind, the focus of this chapter is on the targets and limits established in the 3 above mentioned documents (the Thematic Strategy, the Ambient Air Quality Directive and the NECD). These three documents together aim to consider the multi-pollutant/multi-effect features that play together as illustrated by the below[117]:

The Thematic Strategy

The Thematic strategy sets overall environmental and health objectives and defines target emission limits for 2020. The strategy outlines measures and means that are envisaged to support the attainment of the established objectives. The strategy however does not provide sector specific nor country specific limit values and targets. The key objectives defined in the Strategy are summarised below (targets are defined relative to the year 2000):

[117] Taken from the Commission Staff Working Paper SEC (2005) 1133 that presents the impact assessment to The Communication on Thematic Strategy on Air Pollution and The Directive on “Ambient Air Quality and Cleaner Air for Europe”

2020 targets	Reduction demands compared to 2000
47% reduction in los of life expectancy as a result of exposure to particulate matter 10% reduction in acute mortalities from exposure to ozone 74% reduction of acid deposition in forest areas 39% reduction of acid deposition in surface fresh water areas 43% reduction in areas or ecosystems exposed to eutrophication	82% reduction in SO_2 emissions 60% reduction in NO_X emissions 51% reduction in VOC emissions 27% reduction in particulate matter (PM2.5) emissions

Since the adaptation of the strategy, a number of modelling revisions have been made. The below table shows the targets as they are formulated in the Thematic Strategy and the corresponding targets taking account developments and modelling improvements (e.g. the accession of Bulgaria and Romania, CBA methodological improvements and refined forecast for relevant sectors)[118]:

Table D-1 Policy targets

Indicator	Unit	% improvement compared to 2000 thematic strategy	% improvement compared to 2000 thematic strategy with improvements
Premature mortality from exposure to PM2.5	Years of life lost	47	47
Area of freshwater ecosystem where the critical load for acid deposition is exceeded	Km2	39	54
Area of forest ecosystem where the critical load for acid deposition is exceeded	Km2	74	81
Area of ecosystems where nitrogen deposition exceeds the critical load for eutrophication	Km2	43	32
Premature mortality from exposure to ozone	Number of cases	15	16

[118] Analysis of the Costs and Benefits of proposed revisions to the national emission ceilings Directive, AEA, European Commission DG Environment, 2007; (The table is reproduced also from this report)

Ambient Air Quality

The Directive sets upper and lower assessment thresholds for:

- SO_2
- NO_2 and NO
- PM_{10} and $PM_{2.5}$
- Lead
- Benzene
- Ground level ozone
- CO

The Directive is fairly new, and hence the establishment of the required monitoring systems is still under implementation. Hence, monitoring data to inform an assessment of compliance is still highly limited as illustrated for example by the EEA (see footnote 123) mentioning that the number of stations are expected to increase in the years to come as a result of the Directive.

That being said though, the existing data do indicate that in particular in urban agglomerations the limit values in Directive are often not complied with. Thus, NO_2, PM and ground level ozone are mentioned as a continued cause of concern due to developments in traffic, industry and households (including wood combustion) and climate conditions (of particular relevance to ground level ozone).

National Emissions Ceiling Directive (NECD)

Quoting Article 1 of the Directive: "The objective of this Directive is to limit emissions of acidifying and eutrophying pollutants and ozone precursors in order to improve the protection in the Community of the environment and human health against risks of adverse effects from acidification, soil eutrophication and ground-level ozone and to move towards the long-term objectives of not exceeding critical levels and loads[119] and of effective protection of all people against recognised health risks from air pollution by establishing national emission ceilings, taking the years 2010 and 2020 as benchmarks…".

The Directive sets specific targets (ceilings) for four key air pollutants - ceilings that are specific to each Member State: The below table is a reproduction of Annex 1 to the Directive.

The Directive foresaw a review in 2008 expected to result in future new (and stricter) NECD. However, while efforts have been taken in this regard, new NEC's have not yet been established.

[119] Critical loads are defined in the Directive as a quantitative estimate of an exposure to one or more pollutants below which significant adverse effects on specified sensitive elements of the environment do not occur, according to present knowledge, and critical levels are defined as the concentration of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur, according to present knowledge

Table D-2 National emission ceilings for SO_2, NO_x, VOC and NH_3, to be obtained by 2010 (1)

Country	SO2	NOX	VOC	NH3
Belgium	99	176	139	74
Bulgaria (2)	836	247	175	108
Czech Republic	265	286	220	80
Denmark	55	127	85	69
Germany	520	1051	995	550
Estonia	100	60	49	29
Greece	523	344	261	73
Spain	746	847	662	353
France	375	810	1050	780
Ireland	42	65	55	116
Italy	475	990	1159	419
Cyprus	39	23	14	9
Latvia	101	61	136	44
Lithuania	145	110	92	84
Luxembourg	4	11	9	7
Hungary	500	198	137	90
Malta	9	8	12	3
Netherlands	50	260	185	128
Austria	39	103	159	66
Poland	1397	879	800	468
Portugal	160	250	180	90
Romania (2)	918	437	523	210
Slovenia	27	45	40	20

Country	SO2	NOX	VOC	NH3
Slovakia	110	130	140	39
Finland	110	170	130	31
Sweden	67	148	241	57
United Kingdom	585	1167	1200	297

(1) These national emission ceilings are designed with the aim of broadly meeting the interim environmental objectives set out in Article 5. Meeting those objectives is expected to result in a reduction of soil eutrophication to such an extent that the Community area with depositions of nutrient nitrogen in excess of the critical loads will be reduced by about 30 % compared with the situation in 1990.
(2) These national emission ceilings are temporary and are without prejudice to the review according to Article 10 of this Directive, which is to be completed in 2008.

D.2 Observed compliance gap

When assessing the compliance gap, the main milestones have been identified as:

- The NECD which legally obligates Member States to deliver on the ceilings agreed upon and put into the legislation, and
- The Thematic strategy noting however that this cannot be interpreted as legislation in the strict sense of the word. It does not obligate Member States to deliver on concrete measures. Still, however it sets agreed overall EU targets for impacts and for emissions.

Further, the Ambient Air Quality Directive is of importance in this regard as well. However monitoring data are still not complete and do not in a similar fashion cover the different Member States. Hence, this Directive is not included here.

There is a range of additional legislation in air. This is however in the context of this study considered as legislation that will support the attainment of the above objectives.

Applying the 2010 NEC as the benchmark, the most recent data indicate that compliance gaps in the sense of exceeding the 2010 emission limits are most significant in the case of NO_X. The most recent data are summarised in the below table. For each of the four pollutants for which the NECD establishes ceilings, the table first indicates the emission level compared to the ceiling - for 2008 and for 2010 respectively and for EU as a whole. The 2010 estimates have been provided by the Member States and assume that all existing measures are fully in place. The table further identifies the specific Member States that have reported not yet to have come below the ceiling and the Member States that can be expected not to comply with the ceiling in 2010.

The table clearly illustrates that the NO_X emissions pose the largest challenge to delivering compliance with the NECD in 2010.

The below points to that NO_X constitutes the most problematic parameter as regards NECD compliance gaps at the EU level. As regards, the impacts, ground level ozone, to which NO_X is among the "contributors", is observed to be a challenge still, in particular in urban areas. However, the formation of ground level ozone is caused by a range of factors including climatic conditions, and hence variations can occur from one year to the other. They can thus vary from one year to the other, and climate change is likely to enhance the need for policy focus on this pollutant in the future. It should be noted though that the EEA reviews and reports point to virtually all air pollutants as posing some level of challenge to the European Union with the sole exemption of SO_2. As regards SO_2 and NH_3 the majority of EU Member States are on the track of delivering compliance with the NECD with a few exceptions.

	2008 emissions relative to NEC	2010 expected emissions relative to NEC	Non-compliant Member States 2008 (distance from target)	Non-compliant Member States 2010 (distance from target)
NO_X	114.2	104.0	Austria (58) Belgium (36) Denmark (15) France (57) Germany (33) Greece (4) Ireland (72) Italy (11) Luxembourg (68) Malta (42) Netherlands (13) Slovenia (5) Spain (35) Sweden (4) UK (20)	Austria (42) Belgium (44) France (32) Germany (6) Ireland (58) Luxembourg (16) Malta (14) Slovenia (3) Spain (28) Sweden (1) UK (4)

NMVOC	81.5	85.5	Austria (1) Denmark (24) France (3) Ireland (4) Luxembourg (8) Portugal (10) Spain (19)	Austria (3) Portugal (8) Spain (18)
SO_2	71.0	70.4	Belgium (4) Ireland (7) Malta (80) Netherlands (4)	 Malta (58)
NH3	88.7	91.7	Finland (14) Germany (7) Netherlands (5) Spain (1)	 Germany (11) Netherlands (1) Spain (8)

To illustrate the past trends of NO_X emissions, the below extracts essential information from the EEA NO_X emissions Assessment published October 2010. The information presented relates to EU27.

Year	1990	1995	2000	2002	2004	2006	2008
Emissions (kt in EU27)	17152	14669	12692	12186	12008	11604	10397
Index (1990: 100)	100	86	74	71	70	68	61

Consulting the thematic strategy and noting that PM is among the pollutants covered by the ambient air quality Directive, it is also relevant to consider emissions of particulate matter although national 2010 ceilings have not been established in this regard.

PM is mentioned in the SOER as one of the pollutants of particular concern, the EU emission inventory report[120] for the CLRTAP (to which all Member States are signatories and obligated to report) point to emission reductions for EU27 of 13% for $PM_{2.5}$ and 8% for PM_{10} comparing 1990 to 2008.

[120] EEA Technical Report Nr. 7/2010 "European Union emission inventory report 1990-2008 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)

Change from 1990-2008	$PM_{2.5}$ Country (Gg emissions, reduction)	PM_{10} Country (Gg emissions, reduction)
Increase	Bulgaria (24, 1864%) Denmark (28, 26%) Latvia (25, 11%) Lithuania (10, 17%) Malta (1, 40%) Romania (125, 16%)	Bulgaria (59, 260%) Denmark (35, 18%) Finland (49, 5%) Latvia (27, 10%) Lithuania (12, 31%) Malta (2, 54%) Romania (144, 208%)
Reduction between 0 and 15%	Austria (21, -6%) Cyprus (3, -4%) Estonia (20, -5%) Finland (36, -1%) Germany (110, -19%) Hungary (23, -12%) Poland (131, -3%) Portugal (97, -1%) Slovenia (14, -8%) Spain (125, -1%) Sweden (27, -4%	Austria (36, -3%) Cyprus (4, -13%) Czech R (35, -24%) Germany (203, -14%) France (203, -14%) Poland (263, -7%) Portugal (125, -2%) Spain (160, -6%) Sweden (39, -3%)
Reduction between 15% and 25%	Ireland (10, -16%) Italy (124, -23%) Netherlands (19, -23%) United Kingdom (81, -21%)	Hungary (38, -20%) Ireland (15, -16%) Italy (156, -19%) Netherlands (37, -16%) Slovakia (32, -18%) Slovenia (15, -16%) United Kingdom (133, -23%)
Reduction between 25% and 50%	Belgium (20, -41%) France (282, -25%) Slovakia (27, -16%)	Belgium (30, -37%) Estonia (25, -32%)
Reduction above 50%	Czech R (21, -62%)	

Compared to 1990, it is interesting that emissions have actually increased in as many as 6 Member States, and only five Member States have seen reductions above 25%.

The above table concerns emissions. As regards air quality, i.e. PM concentrations in ambient air, the SOER states that "in many European Urban agglomerations, PM_{10} concentrations have not changed since about 2000".

2010 targets

As regards the 2010 national emissions ceilings for NOx more than half of the Member States exceed those in 2008. Considering the target year of 2010, national projections indicate that improvement will be provided albeit not of a scale that ensures 100% compliance. Overall, it is expected that 2010 will deliver 4% above the ceiling. That being said, the introduction of stricter euro-standards will contribute to an accelerated emissions reduction in particular in the last years of the period leading up to 2020 (as the new vehicles with stricter euro-standards penetrate the market). This is further elaborated upon below.

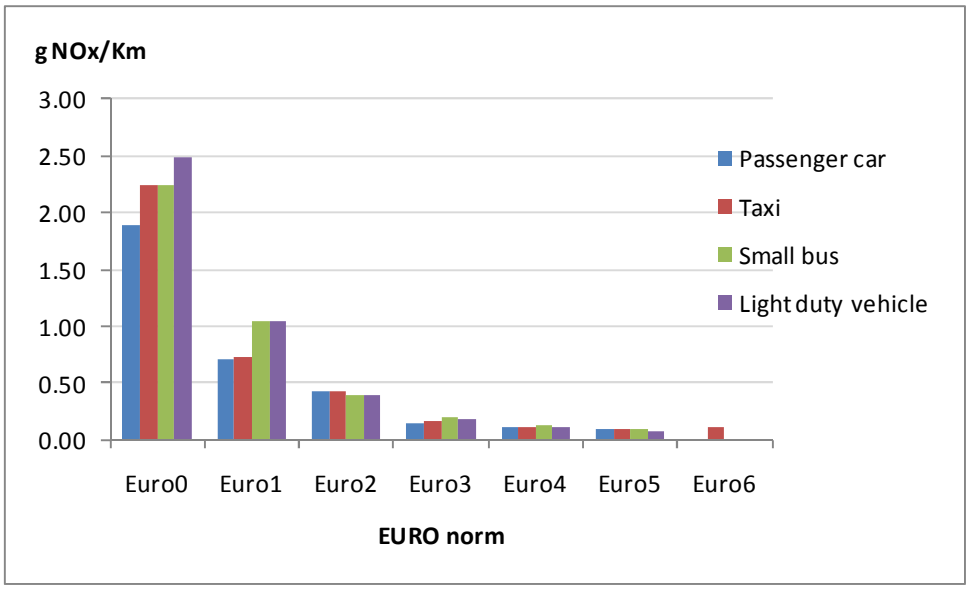
As regards PM there are no specific emission ceilings for individual Member States. However, the thematic strategy points to the substantial (health) benefits that can be delivered through reducing PM emissions, and as mentioned above PM concentrations in urban areas is noted to be an issue of concern. In that respect it PM emissions is an issue of concern.

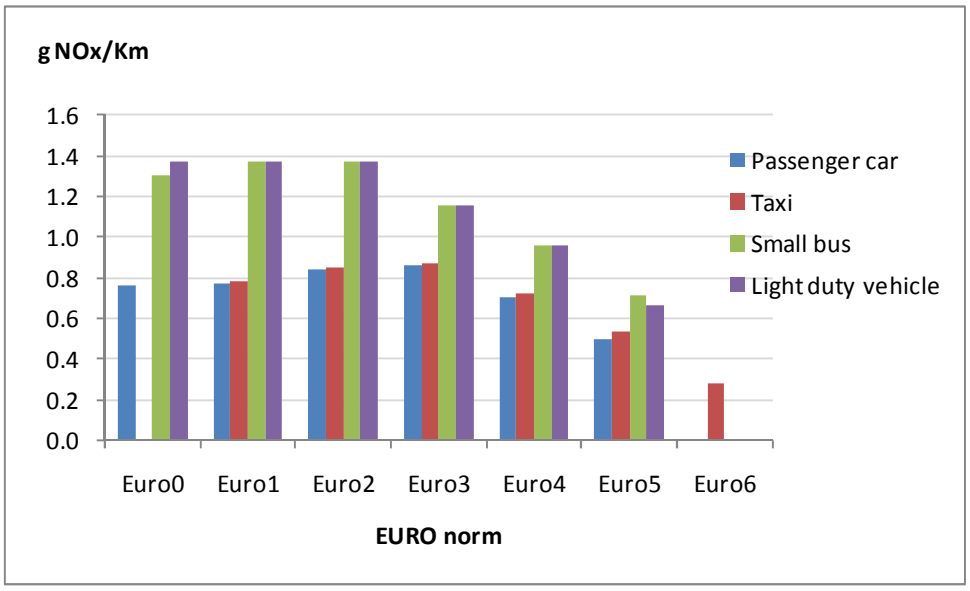
As said, the NECD defines 2010 targets, and a revision has not yet materialised into new targets.

According to the EEA (footnote 123) one of the main reasons behind the difficulties encountered in some Member States in regards to meeting the NEC for NO_X is to be found in the transport sector. Vehicle emissions standards for NO_X have not been as effective as anticipated and furthermore, "…the need to reduce CO_2 emissions has shifted the market in many European countries in favour of more fuel efficient diesel vehicles. In turn, this has caused a slow down of NO_X and PM emission reductions".

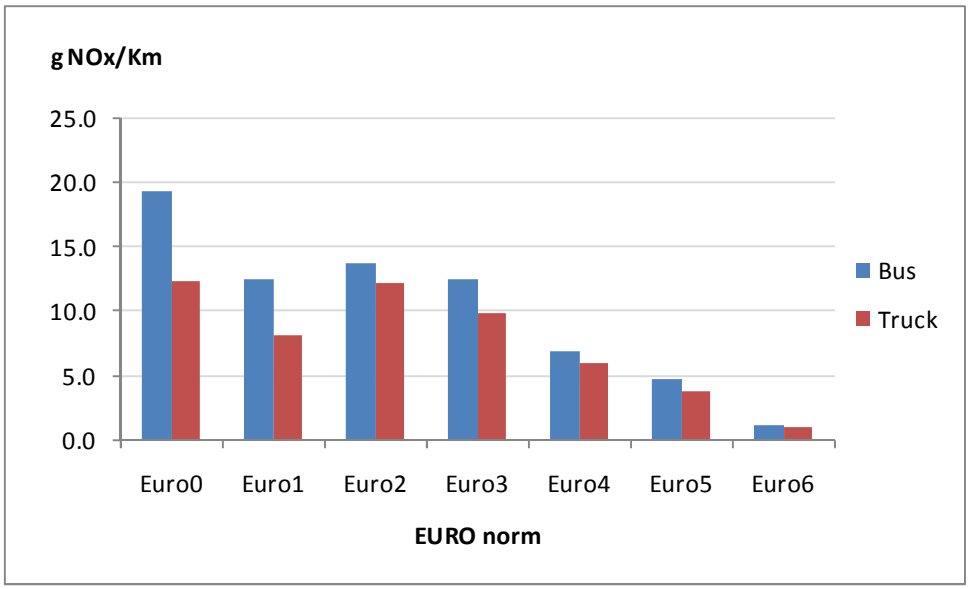
The below table illustrates the NO_X emissions that result from petrol and diesel vehicles respectively. As can be seen, emissions per kilometre are much larger for diesel vehicles than for petrol vehicles[121].

[121] To further elaborate on the norms: for passenger cars, Euro V has entered into force in 2011. The average car today emits however somewhere between the Euro III and IV norm. Euro VI enters into force in September 2015. For light duty vehicles, Euro V enters into force in 2012, and Euro VI in 2016. Last, for heavy vehicles, Euro V entered into force in September 2009, and Euro VI will do so in 2014. Also for these vehicles does it apply that average current emissions are between the Euro III and Euro IV level.





Thus, NO_X emissions can be expected to exhibit a more rapid decline in the next decade as a result of the stricter euro-norms for vehicles. Transport is an important source of NO_X emissions. The below illustrates the NO_X emissions that will result from the coming stricter euro-norms for heavy vehicles:



PM

As regards PM which is mentioned in the SOER as one of the pollutants of particular concern, the EU emission inventory report[122] for the CLRTAP (to which all Member States are signatories and obligated to report) point to emission reductions for EU27 of 13% for $PM_{2.5}$ and 8% for PM_{10} comparing 1990 to 2008.

[122] EEA Technical Report Nr. 7/2010 "European Union emission inventory report 1990-2008 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)

Change from 1990-2008	$PM_{2.5}$ Country (Gg emissions, reduction)	PM_{10} Country (Gg emissions, reduction)
Increase	Bulgaria (24, 1864%) Denmark (28, 26%) Latvia (25, 11%) Lithuania (10, 17%) Malta (1, 40%) Romania (125, 16%)	Bulgaria (59, 260%) Denmark (35, 18%) Finland (49, 5%) Latvia (27, 10%) Lithuania (12, 31%) Malta (2, 54%) Romania (144, 208%)
Reduction between 0 and 15%	Austria (21, -6%) Cyprus (3, -4%) Estonia (20, -5%) Finland (36, -1%) Germany (110, -19%) Hungary (23, -12%) Poland (131, -3%) Portugal (97, -1%) Slovenia (14, -8%) Spain (125, -1%) Sweden (27, -4%	Austria (36, -3%) Cyprus (4, -13%) Czech R (35, -24%) Germany (203, -14%) France (203, -14%) Poland (263, -7%) Portugal (125, -2%) Spain (160, -6%) Sweden (39, -3%)
Reduction between 15% and 25%	Ireland (10, -16%) Italy (124, -23%) Netherlands (19, -23%) United Kingdom (81, -21%)	Hungary (38, -20%) Ireland (15, -16%) Italy (156, -19%) Netherlands (37, -16%) Slovakia (32, -18%) Slovenia (15, -16%) United Kingdom (133, -23%)
Reduction between 25% and 50%	Belgium (20, -41%) France (282, -25%) Slovakia (27, -16%)	Belgium (30, -37%) Estonia (25, -32%)
Reduction above 50%	Czech R (21, -62%)	

The above table concerns emissions. As regards air quality, i.e. PM concentrations in ambient air, the SOER states that "in many European Urban agglomerations, PM_{10} concentrations have not changed since about 2000".

The 2020 targets

According to EEA[123] the current policies and measures are not sufficient to deliver on the 2020 targets:

Theme	2020 target reductions	Distance to target with current legislation
Years of life lost from PM2,5	47%	5%
Ecosystems areas not protected against eutro-phication	31%	11%
Forest areas not protected against acidification	76%	8%
Cases of premature deaths from ozone	26%	1%

In 2007, a study by AEA for the European Commission[124] was carried out as part of the process of reviewing the NECD. This study essentially compared a baseline with current legislation in place including the forthcoming Euro V norms to projections that will deliver on the targets of the thematic strategy. Two alternative calculations are carried out: one that relies on national energy and activity projections and one which takes into account the agreement on 20% reduction in GHG emissions by 2020 and 20% increase in renewable energy in 2020.

The below allows for a comparison - at the EU level - of the health impacts of 1) the continuation of the current policies and legislation including compliance with the NECD with the impacts of 2) delivering on the targets established in the thematic strategy. The table only considers morbidity and hence disregards for example mortality and other impacts than health. These aspects are however included and discussed in the next section on the costs, and the table here merely serves to illustrate that there are missed benefits from not attempting fully to achieve the targets set forth in the thematic strategy. The table also illustrates one other interesting point, namely the fact that there is a significant correlation between the targets of the thematic strategy and the pursuit of the 2020 targets on renewable energy and GHG emission reductions.

	National projections		Coherent projections (including RES/GHG targets)	
Million EUR	Current policy	Thematic strat-egy	Current policy	Thematic strat-egy
Ozone morbid-ity	4423	3938	4167	3938
PM morbidity	53729	40214	45439	40246
Total morbidity	58152	44151	49605	44185

[123] The European Environment, State and Outlook 2010 Air Pollution, 2010

[124] Analysis of the Costs and Benefits of proposed revisions to the national emission ceilings Directive, AEA, European Commission DG Environment, 2007

Overall, one can thus conclude that:

- The NECD will be aligned with, albeit with some delay caused for example by the intensified effort to reduce CO_2 emissions and the consequent large shift to diesel vehicles - reductions will however be delivered as a result of the Euro V norms that have recently been introduced.

- Having said that though, recent projections that for example consider economic recession and later recovery points to it that in certain Member States the NECD may not be fully complied with in 2020[125] although the overall targets will still be met (considering EU27 as a whole). This is a cause of concern, in particular in the light of it that the targets were actually to be complied with by 2010.

Table D-3 Countries that may exceed their NEC in 2020

Emissions in kt	NO_X NEC	NO_X 2020 projection	NH_3 NEC	NH_3 2020 projection
Ireland	65	67-69		
Belgium			74	75
Germany			550	607
Slovenia			353	363

- The current policies are not sufficient to deliver on the targets established in the Thematic Strategy. The ambient air quality Directive provides a legal push to implement the thematic strategy for improving air quality, but there is a need for more (and/or stricter) specific legislation and initiatives to support the attainment of these objectives.

D.3 Cost of non-compliance

The above mentioned 2007 study (AEA) provides the below estimates on the country specific health benefits (PM and ozone). This table reproduces the results from this study and shows the valued annual health benefits from delivering on the 2020 targets.

The table shows the results from model based projections. In alignment also with the CAFE results, mortality is valued using the mean and the median value. The former best presents the WTP, but can be substantially affected by

[125] Baseline Emission Projections and Further cost-effective Reductions of Air Pollution impacts in Europe - a 2010 perspective. NEC scenario analysis report Nr. 7, published by IIASA in August 2010.

even very few extreme values whereas the former is more robust. The discussion below considers the median approach.

For each of these assumptions, the table shows the estimated further benefits that can be harvested when comparing a baseline to the full achievement of the targets of the National Emissions Ceiling Directive. The baseline in this case considers all current policies; assumes that the 2010 National Emission Ceilings are complied with and that the Euro VI measures for heavy duty vehicles are fully implemented.

The table clearly illustrates that without further policy measures being taken, the Thematic Strategy's targets will not be met and there are benefit losses related to this.

The lost health benefits from not achieving the aspirations set forth in the thematic strategy amount to roughly somewhere between 20,000 and 45,000 million EUR per year. The low estimate assumes that the 20/20 targets are delivered upon, and hence initiatives to promote renewable energy and reduce GHG emissions will contribute to reducing also emissions of the air pollutants here. If the mean approach is applied to assess mortality, the benefit loss can be as high as 150,000 million EUR.

In 11 Member States, the benefit loss amount to more than 10 EUR/capita (using the lower mean values for mortality): Belgium, Bulgaria, Czech Republic, Germany, Hungary, Lithuania, Netherlands, Poland, Romania, Slovakia and Slovenia. In Hungary, Poland and Slovakia the estimated benefit loss is actually 15 EUR/capita or higher.

Table D-4 Health benefits from achieving 2020 air quality targets

Country/MEUR per year	Low estimates with mortality valued using the median			Low estimates with mortality valued using the mean		
	National projection	PRIMES coherent projection	Co-benefits (from coherent projection)	National projection	PRIMES coherent projection	Co-benefits (from coherent projection)
Austria	770	274	496	2367	841	1526
Belgium	1542	654	888	4768	2019	2749
Bulgaria	697	321	376	2614	1204	1410
Cyprus	9	3	6	22	6	16
CR	1385	463	922	4498	1503	2995
Denmark	364	137	227	1213	455	758
Estonia	66	14	52	240	49	191
Finland	146	44	102	462	138	324
France	5524	2389	3135	15962	6898	9064
Germany	9372	3485	5887	31630	11745	19885
Greece	663	206	457	2386	738	1648
Hungary	1566	546	1020	5696	1982	3714
Ireland	159	63	96	400	158	242
Italy	5011	1917	3094	18249	6969	11280
Latvia	140	38	102	361	97	264
Lithuania	211	73	138	988	340	648
Luxembourg	60	24	36	141	57	84
Malta	21	5	16	60	15	45
Netherlands	2031	853	1178	5996	2517	3479
Poland	6180	2085	4095	18956	6384	12572
Portugal	911	137	774	3048	450	2598
Romania	2951	1437	1514	9982	4861	5121
Slovakia	806	294	512	2400	875	1525
Slovenia	226	98	128	749	324	425
Spain	1864	642	1222	6004	2039	3965
Sweden	324	111	213	1012	344	668
UK	4241	1910	2331	11771	5299	6472
EU27	47240	18223	29017	151975	58307	93668

As regards effects on nature and ecosystems, the estimates provided are few and scattered reflecting difficulties in establishing comparable data and sufficient time series, and resulting in some cases in it that damage estimates are only provided for a few Member States. Hence, reference is rather made to the below more recent study from IIASA which points to an order-of-magnitude deviation from the targets of the Thematic Strategy.

A more recent study - which does not however go as much into detail regarding the Member State specific benefit loss - is the study published by IIASA in 2010[126]. The results of this are not immediately comparable to the above, although the methodologies and the assumptions are fairly similar. This is due to among other things that the IIASA study rests on recently updated PRIMES projections that take into account the recent economic recession. Recent policy developments are also taken into consideration. This applies to the forthcoming introduction of Euro VI norms for heavy vehicles, recent decisions in the context of IMO (having an impact on emissions from international shipping - the size of which will however be much larger after 2020), and the new Industrial Emissions Directive.

The focus of the study however is on the cost side, and hence benefit are quantified but not valued.

The study is model based and considers two different PRIMES scenarios. Both are very recent and take into account the effects of the economic recession and developments in population. Both also take into account the objectives of the EU Climate and Energy package, but only one of them fully incorporates the renewable energy target.

The projections allow for a comparison of two scenarios that are relevant in this context:

- A baseline which projects emissions and impacts in 2020 taking into account all existing legislation in all relevant fields including agriculture, energy and environment.

- A projection which assesses cost-effective path to delivering compliance with the 2020 targets as they were established in the thematic strategy.

The below table compares the emission levels that results from these scenarios. First, the table shows that assuming that all existing legislation is complied with the NECD 2010 targets will be delivered in 2020[127] considering EU as a whole - in alignment with the above conclusions. Further, the table illustrates that even with the full implementation of all legislation that is currently in place, the targets of the thematic strategy will not be delivered. In particular as regards particulate matter and ammonia, the distance is quite substantial from the reductions needed to deliver fully on the objectives of the Thematic Strategy. The model calculations show that a reduction in ammonia emissions in the order of 25% would be necessary whereas the achieved reductions will only be 8%. Last, the table also illustrates the contribution from the RES targets.

[126] Baseline Emission Projections and Further cost-effective Reductions of Air Pollution impacts in Europe - a 2010 perspective. NEC scenario analysis report Nr. 7, published by IIASA in August 2010.

[127] These calculations only consider 2020, and therefore this year is mentioned. The NECD targets should actually be complied with in 2010.

Table D-5 Emission targets and scenarios

Pollutant	Emission level in 2000	NEC target 2010	2020 projection without RES targets	2020 projection with RES target	Reduction provided by RES	Reduction		Thematic strategy objectives[128]
						Without RES target	With RES target	
SO2	10385	8297	2732	2626	206	74	76	76-78
Nox	12251	9003	5553	5433	120	55	56	57-58
PM2.5	1798		1065	1089	-24	41	39	43-47
NH3	4021	4294	3706	3708	-2	8	8	25
VOC	11659	8848	5938	6018	-80	49	48	49-50

The below table illustrates the calculated benefits for EU27.

Table D-6 Benefits of air quality targets

Impact improvements	2000	2020 without RES	2020 with RES	Target without RES	Target with RES	Scenario with RES		
						Distance from target	Delivered reduction %	Target reduction %
Loss in statistical life expectancy attributable to PM exposure	8,0	4,1	4,1	3,8	3,8	0,3	48,8	52,5
Loss in years of life lost attributable to PM exposure	200,9	116,4	115,6	106,4	106,4	10	42,5	47,0
Cases per year of premature mortality attributable to exposure to ground level ozone	22704	17151	17091	16895	16878	256	24,7	25,7
Ecosystem area with nitrogen deposition exceeded the critical loads for eutrophication[129], km2	1188398	952572	946905	822992	818665	129580	20,3	31,1
Forest area with acid deposition exceeding the critical loads for acidification, km2	280301	91663	88842	70677	66824	20986	68,3	76,2

Similarly to emissions result, the table shows that while full implementation of current legislation will certainly provide significant improvements compared to the 2000 level, the targets set forth in the thematic strategy will not be fully achieved with existing legislation.

[128] The targets have been modified in the study to reflect more recent knowledge and economic developments - and hence these emission targets will deliver the desired impacts

[129] The report also calculates this impact using "grid average deposition" in order to check consistency with the thematic strategy. However, the estimates shown in this table are "ecosystem-specific deposition" and the method that has been used for target setting in these projections.

A recent study[130]assesses the implications air pollution from a Danish perspective. Also this study applies a model based approach[131] which diverts in some respects from the CAFÉ methods. Still, order-of-magnitudes of results are assessed by the authors to be fairly comparable. According to this study, 3000-4000 people die prematurely each year in Denmark due to the present levels of atmospheric pollution. This study looks only at the health related impacts. The study concludes that the number of premature deaths in Denmark due to air pollution would be 2200 in 2020. Apart from fatalities health costs also arise due to illness. Considering the health costs, the study concludes that Danish emissions result in EU cost in the order of 4.9 billion EUR/year of which 0.8 billion/year fall in Denmark.

Also, the study identifies the main sectors that contribute to the health effects, and identifies agriculture as the largest single contributor (accounting for around 40% of the total health costs). Last, this study points to Denmark as a net exporter, in the sense that Denmark suffers less (4.5 billion EUR/year) from all air pollution sources in Europe than what Denmark inflicts on others (4.9billion EUR per year).

To further illustrate the health implications of air pollution, an EEA study of 2005[132] stipulates that 'Poor indoor air quality is the source of a number of health problems, including cancer, allergic symptoms, distress, sleeping and concentration problems, and coughing, wheezing and asthma-like symptoms in children'. The same study makes a reference to a WHO evaluation 2004 indicating that 'air pollution was responsible for approximately 100 000 deaths and 725 000 years of lost life (DALYs) each year in a selection of European cities within the WHO European region'. The more recent estimates of the impact of air pollution made in the European Commission 'Clean air for Europe' (CAFE) programme found that in the EU about 350 000 people died prematurely in 2000 due to the outdoor air pollution caused by fine particulate matter ($PM_{2.5}$) alone.[133] This corresponds to an average loss of life expectancy of about 9 months for every EU citizen. Finally, a study in the Netherlands indicated that PM10, noise and materials like radon contributed to 2 to 5% of total illness.[134]

[130] Assessment of health-cost externalities of air pollution at the national level using the Eva model system, Centre for Energy, Environment and Health (CEEH), Report Scientific Report No 3. ISSN: 1904-7495, Roskilde March 2011

[131] Integrated model system, EVA (Economic Valuation of Air pollution) based on the impact-pathway chain.

[132] EEA Report No 10/2005, Environment and health.

[133] EC (2007) Together for Health: A Strategic Approach for the EU 2008-2013. Commission Staff Working Paper, COM(2007) 630 Final

[134] Bouwstenen voor gezondheid & milieubeleid, RIVM Briefrapport 630789001/2007, bijlage bij briefnummer 200/2007

Appendix E Other sectors

The other sectors covered include chemicals and noise. The key legislation is presented in Table E-1.

Table E-1 Legislation in other sectors

	Directive	Comments
Chemicals	REACH	Current implementation can be assessed using the registration status as an indicator.
	Other chemicals legislation	Biocides, pesticides etc sets out harmonised criteria for chemical products.
	Seveso II Directive	Protection against major accidents. No quantified targets and generally MS are in compliance.
Noise	Directive on Environmental Noise	No quantified limit values - require mapping and action plans.
	Other noise legislation	There are various directives and requirement on noise from specific sources e.g. road vehicles. Generally harmonised rules and compliance.

E.1 Chemicals

Gaps

Much of the EU legislation regards the conditions for chemicals or products containing chemicals to be placed on the markets. REACH, for instance, requires that chemicals have been assessed against health and environment risks and registered with the European Chemicals Agency. Recommendations for safe use of chemical products must be handed over to recipients. Risks which are not controlled sufficiently by the industry are addressed through restrictions and authorisation requirements. As the REACH regulation is relatively new there is currently limited evidence on compliance with this legislation.

For the legislation such as international conventions (e.g. on POPs) the progress towards the commitment can be assed. The reporting shows that Member States are in compliance regarding setting up inventories for intentionally produced POPs and developing actions plans for unintentional release.

There is still some progress needed regarding actual source reduction through industrial emissions (former IPPC) legislation requiring BAT etc. Also emis-

sion inventories are not complete covering all POPs and environmental media[135].

Overall the legislation on chemicals is supposed to minimise significant adverse effects on human health and the environment and reduce or phase out dangerous chemicals where it is economically and technically viable.

Costs

Phase-out of dangerous chemicals will have important environmental and health benefits. As part of the preparation for REACH, estimates ware made illustrating that the benefits could be substantial. According to the Extended Impact Assessment[136], using prudent assumptions, the total health benefits would be in the order of magnitude of €50 billion over next 30 years. The annual costs are estimated to 4-5 billion EUR.

There is spillover effects to for example waste as phasing out dangerous substances make waste less hazardous and thereby it can impacts on waste management costs that will be reduced.

Still the quantification and monetisation of the benefits are difficult. The reason for invoking restrictions is a risk assessment demonstrating that toxicologically established safe exposure levels are exceeded. In many cases restrictions or phase-out of chemicals are associated with the uncertainty as to the actual magnitude of the impacts on human health and the environment. Society has a willingness to pay for the reduction of the risks associated with dangerous chemicals and that willingness might very large for chemicals for example known to persistent and bio-accumulative.

E.2 Noise

Gap

The Environmental Noise Directive (END) includes various requirements on mapping of noise exposure and developing action plans. A recent study has reviewed implementation in the Member States which shows some progress both in terms of noise mapping and action plan development[137]. Noise, however, continues to be a problem with adverse effects on health and learning.

Urban environments are the most affected by Noise pollution, in particular from traffic.[138] Based on available noise exposure data, roughly 50 million people living in agglomerations above 250,000 inhabitants are subject to long

[135] Bipro 2009 *Support related to the international and Community work on Persistent Organic Pollutants - updated synthesis report 2009*

[136] http://ec.europa.eu/environment/chemicals/reach/background/docs/eia-sec-2003_1171.pdf

[137] Milieu et al. 2010; Review of the Implementation of Directive 2002/49/EC on Environmental Noise

[138] L.C. (Eelco) den Boer, A. (Arno) Schroten (2007) Traffic noise reduction in Europe CE Delft, March

term average noise levels about 55dB[139]. Member States and cities differ substantially in noise pollution as visualised.

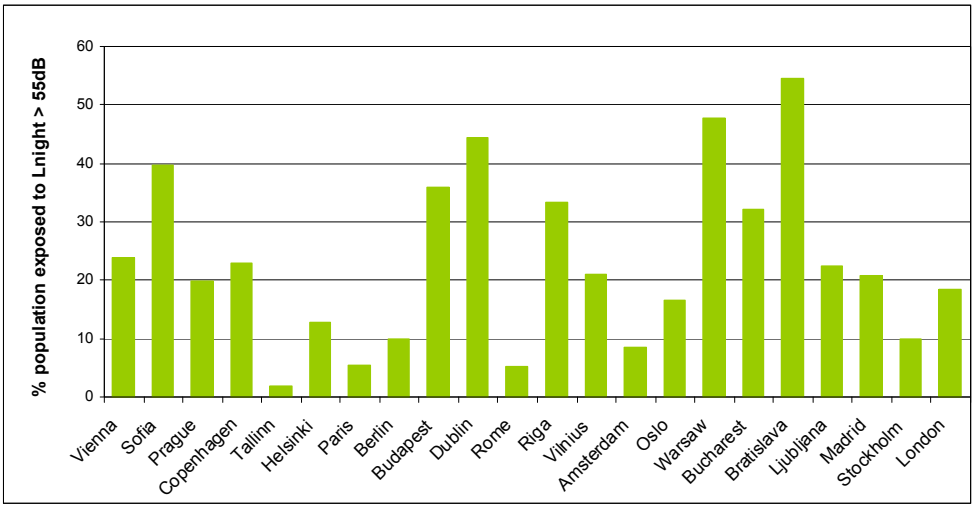


Figure E-1 % of population exposed to Noise pollution over 55dB at night (EEA, 2010)

One possibility for varying degree of implementation and noise reduction may be that is no binding requirement.[140] Moreover, technical expertise and resources are becoming scarcer in the wake of the economic recession which impacts on implementation of the END.

Costs

It is not possible to estimate the effect of improvements made on the exposure to noise or the expected effect when the action plans are implemented. Therefore, the costs of not implementing the noise legislation are explained by examples of societal costs from excessive noise levels derived from a growing set of literature investigating the negative effects of noise. Emerging evidence suggests that noise pollution has negative effects on amenity values, public health, learning rates of children, irritations and local ecology.[141]

There are several approaches to calculating the societal costs of noise pollution based on common environmental economic techniques such as Willingness to Pay (WTP), hedonic pricing, and contingent valuation. The most straightforward is to assess the costs of health effect related to environmental noise. The commonly used limit for when noise generate measureable adverse health effects is 55dB (Average). More vulnerable groups and individuals can of course be negatively affected below 55 dB, which makes calculations using this limit conservative in nature.

[139] EEA (2010) *The European Environment: State and Outlook 2010*

[140] Nevertheless, 20 out of 27 MS has legally enforced noise value limit often in accordance with WHO recommendations (Milieu et al. 2010).

[141] DEFRA (2008) An economic valuation of noise pollution. First report of the Interdepartmental Group on Costs and Benefits, Noise Subject Group.

One study from 2007[142] which uses the 55dB (average) limit, estimates that 245,000 in the EU25 to suffer from cardiovascular diseases related to traffic noise only, from which 20% suffer a lethal heart-attack and thereby dying prematurely. In money terms, the same study calculate the societal costs to €38 billion annually in EU22 with about 90% being caused by road traffic. An additional €2.4 billion are related to rail traffic.

We intend to calculate the by looking at the negative effects of noise in Europe. In 2008, DEFRA published a study which uses a similar approach. It estimates that in the UK only, £7 billion are lost annually due to noise pollution.[143] The cost posts are £3-5 billion in annoyance costs, £2-3 billion in adverse health costs and £2 billion in productivity losses. Using current exchange rates (May 2011), the DEFRA estimate implies almost €8 billion.

The WHO recently (2011) investigated the health cost for excessive environmental noise in Europe. The effects are expressed in disability-adjusted life years (DALYs) meaning "*the sum of the potential years of life lost due to premature death and the equivalent years of "healthy" life lost by virtue of being in states of poor health or disability*".[144] Based on noise maps (as mentioned in the END) the report makes the following estimations:

- 61,000 years are lost due to ischaemic disease in the high-income Europe.
- 45,000 years are lost due to cognitive impairment among children aged 7-19.[145]
- 903,000 years are lost due to sleep disturbance for people living in cities with over 50,000 inhabitants.
- 22,000 years are lost due to Tinnitus, a disease defined as "*the sensation of sound in absence of an external sound source*"
- 537,000 years are lost due to annoyances created by excessive environmental noise levels for people living in cities with over 50,000 inhabitants.[146]

In total, almost 1.6 million DALYs are lost due to noise pollution in Europe.

[142] L.C. (Eelco) den Boer, A. (Arno) Schroten (2007) Traffic noise reduction in Europe CE Delft, March

[143] DEFRA (2008) An economic valuation of noise pollution. First report of the Interdepartmental Group on Costs and Benefits, Noise Subject Group.

[144] WHO (2011) *Burden of disease from environmental noise Quantification of healthy life years lost in Europe*. Regional Office of WHO in Europe

[145] Using extrapolations from Sweden regarding distribution and population structures.

[146] WHO (2011) *Burden of disease from environmental noise Quantification of healthy life years lost in Europe*. Regional Office of WHO in Europe

We then use the Value of a Life Year (VOLY) concept which aims to give a monetary value to year of life.

$$\text{Societal costs} = DALY_{noise} \cdot VOLY$$

In one of the most extensive an accepted contingency studies, the value of a life year (VOLY) has been estimated by Desaigues et al. to an average of €40,000 per year for EU-25.[147]

Applying that number to the 2011 WHO study the societal costs of noise pollution result in €64 billion lost per annum. The results are estimated to be fairly robust considering earlier studies on EU22 estimating the costs of traffic noise to €40 billion[148] and or the UK only to €8billion.

Beyond health effects the impact of noise disturbances are difficult to capture in terms of costs. There are no significant spill-over effects expected.

[147] Desaigues et al. (2006) Final report on the monetary valuation of mortality and morbidity risks from air pollution. Deliverable within FP6 project: NEEDS.

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Appendix F Litigation costs

Not implementation of the environmental acquis can lead to legal actions initiated either by an affected party in the respective Member State or by the European Commission.

Formal legal actions taken by the European Commission follows the infringement procedure, but a more informal approach has been established. The EU Pilot initiative has the objective of supporting the implementation of EU legislation through a more informal partnership approach.

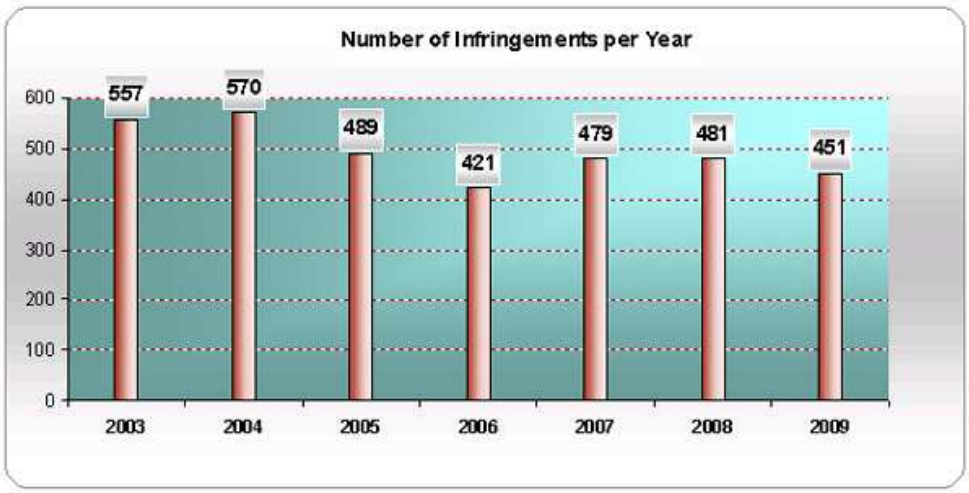
F.1 Costs of infringement cases

The number of infringement cases being open every year is an indicator of the possible implementation or compliance gaps in Member States. The statistics about the recent year's cases are shown in this section.

F.1.1 Statistics on cases

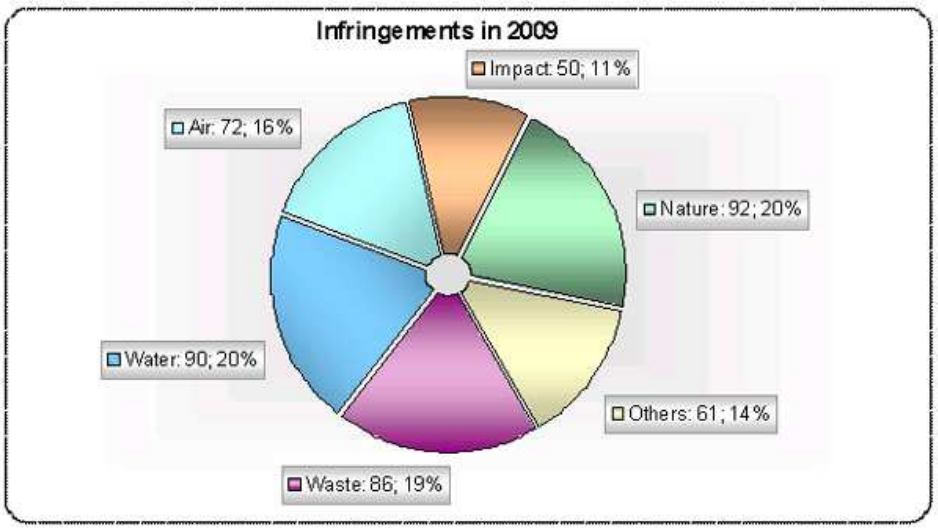
The number of infringement cases in relation to the environmental legislation has been more of less constant though a slightly decreasing trend can be seen.

The figure shows the number of infringement cases related to the environment and about 20% of all infringement cases are within environment. The statistics refer to open cases so cases that have been solved informally for example through the EU Pilot process are not included in these numbers.



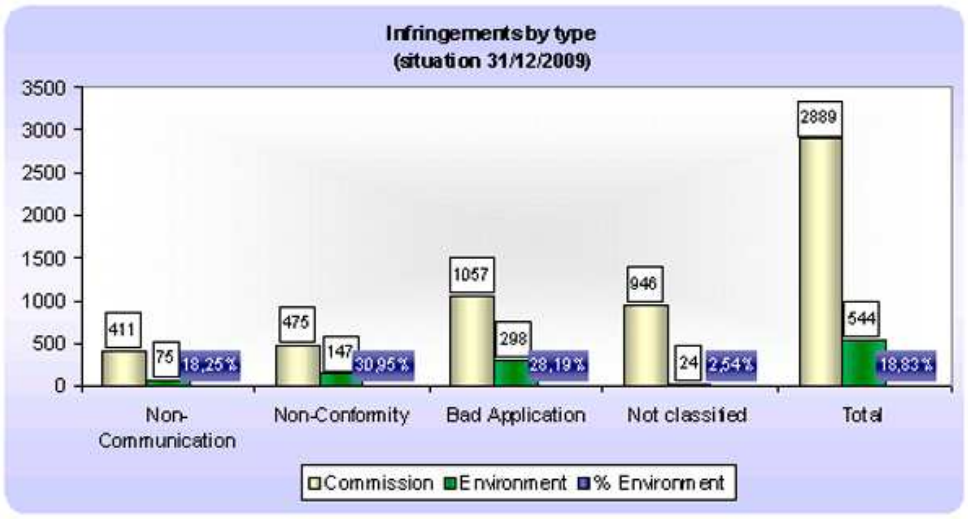
Source: European Commission

The environmental areas of nature, water and waste comprise each about 20% of all cases, while there slightly less within air and other horizontal legislation.



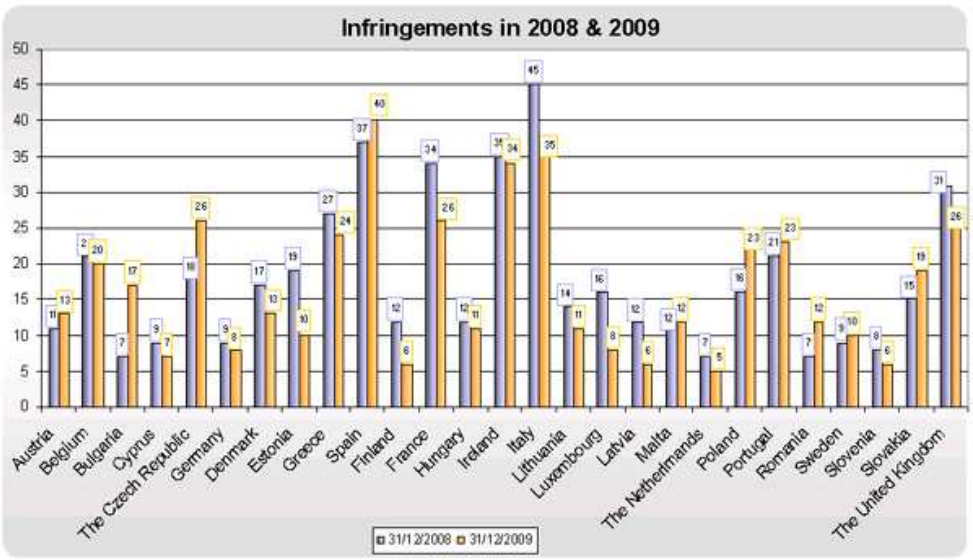
Source: European Commission

Not all infringement cases are about implementation gaps with the same environmental impact. Though provision of information is important, it might not have large impacts. Bad application is the most serious type of infringement in relation to actual environmental impacts. The below figure illustrates that more than half all cases within environment are about "bad application" and about 25% are non-conformity cases.



Source: European Commission

The high number of bad application is indicator of implementation gaps that can lead to costs.



Source: European Commission

The number of infringement cases can be used as one indicator for the overall implementation level in each Member State. Based on the data for open cases in 2008 and 2009 (average number of cases over the two years) the following picture can be drawn:

- More than 30 cases (2008 and 2009): Spain, Ireland and Italy
- Between 20 and 30 cases: Belgium, Czech Republic, Greece, France, Portugal and the UK
- Between 10 and 20 cases: Austria, Bulgaria, Denmark, Estonia, Hungary, Lithuania, Luxemburg, Malta, Slovakia,
- Less than 10 cases: Germany, Finland, Latvia, The Netherlands, Romania, Sweden, Slovenia

The Member States -most recently jointed -have still many specific time derogations (Bulgaria and Romania). There is an increase from 2008 to 2009 in the number of infringement cases. Other new Member States also have time derogations, thus one could expect the number to increase in the future as the extended deadlines are pasted.

F.1.2 Costs of infringement cases

The costs related to infringement cases include:

- Direct costs:
  - The time spend by the Member States official
  - Any legal fees

- If the case is brought for European Court of Justice and lost:
  - Financial penalty
  - Costs of the case

- Indirect costs
  - Disruption of normal work assignments for the involved officials
  - Knock-on effects on other policies etc as they are not being "looked" after while the case is ongoing.

The most significant "cost" of the infringement cases for the affected Member States is not the amount of man-days spend to deal with the cases, but that they interrupt the normal working routines and if certain key staff for a longer period of time are committed on such cases.

Infringement cases that are brought the ECJ and lost could lead to significant financial costs for the Member State. The most recent case has seen a lump-sum fine of 10 million EUR[149]. So far there are only few environmental cases where a financial penalty has been sentenced.

F.2 Costs related to the EU Pilot procedure

F.2.1 Background etc of the EU pilot

The objective of the EU Pilot project is to support the Member State in the implementation of EU legislation in a more partnership approach.

After 22 month of operation, a total of 723 files have been opened through the EU pilot and out of that 36% related the issues dealt with by DG Environment which is 260 files.

This number indicates the need for support in the implementation. It is yet to early to assess the overall success of EU pilot in terms of significantly improving the implementation of the environmental acquis.

F.2.2 Cost of the EU Pilot

There is data on the total resource use for this initiative. To the extent that it supports Member States in their implementation, the costs in terms of the time spend by Member States officials can be seen as part of the overall implementation costs so that it is not adding costs but maybe saving costs by more effective and efficient implementation.

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