

# **THE BENEFITS OF COMPLIANCE WITH THE ENVIRONMENTAL ACQUIS FOR THE CANDIDATE COUNTRIES**

**ECOTEC et al 2001**

## 1. Introduction

### 1.1. Aim of the Study

The aim of this study<sup>1</sup> is to explore and estimate the environmental, economic and social benefits that are likely to arise from the full implementation of the EU environmental legislation (known as the “*acquis communautaire*”) in the candidate countries.

The debate has to date often focused on the costs of compliance with EU legislation and the difficulty of finding sufficient money to fund the necessary investments. There has, however, been little discussion about the benefits that EU environmental directives will imply for the candidate countries, both in environmental and economic terms. The hidden costs to the economy caused by lower environmental standards through a loss of output and inefficient production have not either been taken properly into account. An analysis of the benefits resulting from implementing EU environmental legislation in the candidate countries is necessary to get a full understanding of the real effects of their accession to the EU and to ensure that environmental concerns are given the attention, priority and funding that they deserve.

To address the imbalance in the debate, this study explored the benefits of compliance, in three steps:

- **Type of Benefits:** What type of benefits arise from implementing the *acquis* and some examples of these benefits in the candidate countries – e.g. health impacts, impacts on agriculture, buildings. (*also known as “Qualitative benefits”*)
- **Extent of Benefits:** What is the extent of the benefits – e.g. how much are emissions reduced and how many cases of respiratory diseases are avoided? (*also known as “Quantitative benefits”*)
- **Value of Benefits:** What is the economic value of the avoided costs – e.g. how much would the reduced emissions and damages avoided by implementing EU directives be worth? (*also known as “Monetarised benefits” and given in million €*)

We need to keep in mind that it is not always possible to clearly evaluate the impacts of an EU Directive and, where it is possible, there is always considerable uncertainty in doing so. The final step, estimating the value of benefits, is the most difficult as it raises important ethical questions. The benefits represent the level of income people would be willing to give up for a specific benefit, for instance clean drinking water or avoiding illness, and the value to the society as a whole of avoiding a number of cases of premature death. They are not a measure of increased national wealth or GDP. Whilst people make decisions that have an impact on their environment every day - the acceptance of a certain level of pollution is in itself proof that people do not value their health above all other concerns - it is difficult to estimate the value of these benefits from their actual actions. Nevertheless, assessing what the benefits are worth is a useful tool for understanding the implications of implementing EU directives or of delaying their implementation. This is why the study includes this analysis.

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<sup>1</sup> Carried out by ECOTEC Research and Consulting Ltd, and supported by the Institute of European Environmental Policy (IEEP), EFTEC, Metroeconomica, TME, and experts from across the Candidate Countries.

## 1.2. Background of the study

The candidate countries are facing the very large challenge of transposing EU environmental directives into their national legislation, implementing and enforcing them. The environmental acquis comprises around 300 Directives and Regulations, including daughter directives and amendments, and has been estimated to require an investment of around 80 to 120 billion € for the ten Central and Eastern European countries alone<sup>2</sup>. This broadly amounts to annual investment costs of around 10 billion €. At the same time, the candidate countries are aligning with EU legislation in other policy sectors as well. In many of these sectors, there are also considerable needs but the resources, both financial and administrative, are limited.

In the environmental sector, some of the challenges include:

- Improving and extending the water supply networks to ensure that safe drinking water is available to all agglomerations.
- Improving and extending waste water collection and treatment plants.
- Ensuring that air emissions from large combustion plants are reduced.
- Improving air quality, notably in many urban centres.
- Ensuring that dangerous substances released from installations are controlled and risks of accidents are minimised.
- Collecting, treating and disposing of waste from households, industry and hospitals.
- Cleaning up contaminated land and rivers where water quality is unacceptable.
- Protecting eco-systems, habitats and species from economic and environmental pressures.
- Reducing emissions of pollutants from economic sectors such as large industrial plants and agriculture.

These challenges are not unique to the candidate countries: all EU Member States have faced and still face many of these challenges. However, the candidate countries need to carry out particular efforts because of lower environmental investments in the past, particularly under the previous regimes.

Addressing these challenges can lead to a large number of benefits. These include:

- Better public health as exposure to pollution is reduced and, as a result, the number of respiratory diseases and premature deaths decreases.
- Less damage to forests, buildings, fields and fisheries through a reduction of acid rain and other forms of pollution.
- Promotion of tourism as a result of a cleaner environment (forests, rivers).
- Reduced risk of water-related illnesses and improved taste of water as a result of better water quality.
- Increased economic efficiency and higher productivity as a result of modern technology and lower production and maintenance costs through cleaner water.

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<sup>2</sup> Turkey, Cyprus and Malta not included

- Lower consumption of primary material as a result of a more efficient use and higher levels of reuse and recycling.
- Better protection of natural ecosystems for future generations.

### *Economic Growth and the Environment*

The benefits will depend on the decision taken by the candidate countries as well as the economic development they choose. There are basically three options:

- a) Business-as-usual. Economic growth leading to increased environmental damage and higher economic, social and health costs.
- b) Economic development while reducing the impact on the environment. Applying cleaner technology and minimising waste without any fundamental change to economic decision making.
- c) Sustainable development. Continued economic growth but with a significantly reduced impact on the environment taking fully into account environmental and social concerns into the decision making process.

The sustainable development option is more or less in line with the European Commission's proposal for a 6<sup>th</sup> Environmental Action Programme (and forthcoming Sustainable Development Strategy) according to which the aim should be a continued economic and social development without detriment to the environment and natural resources.

## **1.3. Approach of the study**

### *Types of Benefits*

The main benefits explored include:

- Health benefits: direct benefits to public health, e.g. reduction of diseases.
- Resource benefits: benefits to parts of the environment used commercially, e.g. forestry and fisheries.
- Ecosystem benefits: benefits to the natural environment with no commercial interest.
- Benefits that are not directly related to the environment, such as increased economic efficiency and higher productivity for companies as a result of modern technology.

In addition, there are also social benefits such as the protection of the cultural heritage and recreational opportunities as well as avoided costs, for instance reduced maintenance and clean up of building surfaces.

The study looks at each of these benefits with a different approach. Some benefits cannot be measured, as there is no clear data on their impact. In this case, the study provides a general description of the benefits. For other benefits, there is some data for the results of implementation but a monetary value cannot be determined. Here, the study will describe the extent of benefits, for example, how many tonnes of emissions into air are avoided as a result of EU directives. Finally, the study will provide a monetary value for certain benefits, where data is available.

### ***Coverage of EU Directives***

The study covers the EU Directives that are likely to offer the most significant benefits. A list of these Directives is presented in Table 2, alongside the type of benefits to be expected from each directive.

Most of these directives are likely to be fully implemented by 2010 in the candidate countries. The study therefore takes 2010 as the date by which full implementation is expected<sup>3</sup>. The level of benefits over the full eleven year period (1999 is used as basis year) depends fundamentally on when the directives are actually implemented or, in other words, when the benefits begin to accrue. If implementation is delayed, then the annual benefits estimated above will not occur for many years.

### ***Coverage of Countries***

The study covers all thirteen candidate countries – Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovak Republic, and Turkey.

The assessment looks primarily at the benefits to each country resulting from their own domestic initiatives to implement the EU directives. However, some cross-border and trans-national impacts are also explored, in particular for air pollution. This includes benefits to EU Member States as well as to third countries.

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<sup>3</sup> The landfill directive constitutes an exception as some requirements might not need to be implemented before 2020. To cover all uncertainties, the study also uses three implementation scenarios, based on achieving full compliance by 2005, 2010 and 2020 respectively. Furthermore, to allow a single measure of the benefit to be calculated for the whole period of analysis, a core discount rate of 4% is used, and different discount rates are used to check the sensitivity of the results.

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## 2. Results: Description of Benefits for the Candidate Countries

Fully implementing the EU environmental directives will lead to significant benefits for health, resources and eco-systems (see Table 1). Particularly important benefits are noted after the table.

**Table 1: Types of Benefits**

Type of Benefit	Air	Water	Waste	Nature
<b>Health Benefits</b>	Avoided respiratory illnesses and premature deaths	Households access to cleaner drinking water	Reduced risk of poisoning and accidents due to methane leakage from landfills	None assessed
<b>Resource Benefits</b>	Avoided damage to buildings and crops	Cleaner bathing water and cleaner water for companies	Reduced input of primary material	None assessed
<b>Eco-systems</b>	Avoided global warming from CO2 emissions	Improved river water quality	Avoided global warming from methane emissions	Protected areas and species

### Health benefit

The following benefits arise throughout all the candidate countries, where pollution levels are currently significant and will be reduced through the implementation and enforcement of EU environmental legislation:

- Fewer respiratory diseases and fewer cases of premature death as a result of improved air quality. Benefits are expected across all candidate countries and are particularly important for particulate matter and urban ozone. This pollution arises mainly from emissions from power stations, industry and traffic. Implementing the Large Combustion Plant Directive (LCPD), the Integrated Pollution Prevention Control (IPPC) Directive, the Fuel Quality Directives and the Air Framework Directives will help address these problems.
- Safer environment for children as a result of lower lead emissions, particularly from industry and fuels. These problems can be minimised through the IPPC Directive for industry and the Fuel Quality Directives for lead emissions from transport.
- Better health as a result of less dioxins and heavy metals emitted from below standard incinerators. This can cause cell malfunctioning, either directly, through respiration, or indirectly, though absorption in the food chain. The implementation of the Incineration Directives will help address this problem and reduce the risk of cancers and malformations.
- Positive health impacts and improved safety from a better management of landfill sites and of hazardous waste as well as the capture of landfill gas, which can cause explosions or leakages. These benefits result from implementing the requirements of the Landfill Directive.

- Fewer cases of gastric illness and irritations to skin caused by poor water quality and high concentrations of contaminants in polluted rivers, lakes and coasts. Implementing the Urban Waste Water Treatment Directive can help avoid these negative impacts on health. This will be particularly beneficial where the downstream rivers, lakes and coastlines are of significant recreational value (e.g. coasts of Cyprus, Malta, Turkey).

#### **Resource benefits**

- Improved protection for fish stocks, which are damaged by current pollution levels. This is due to releases of heavy metals, excess fertilisers, untreated wastewater and pesticides. The implementation of the Directive on the Discharge of Dangerous Substances to water and the Urban Waste Water Treatment Directive will reduce these damages.
- Tourism can also be supported through cleaner bathing water and better water quality. There can also be benefits to companies as pre-treatment of water can be reduced and hence production and maintenance costs lowered.
- Reduced production or import of primary materials such as metals, paper and glass. This will result from the proper implementation of the Landfill Directive and the Packaging Waste Directive.

#### **Eco-system benefits:**

- Better protection for eco-systems, which are under particular pressure from air and water pollution and from certain economic activities (e.g. road constructions and intensive agriculture). Acid rain is a significant pressure on land-based eco-systems, such as the Black Triangle – parts of Poland, Czech Republic and Germany. This problem will be reduced with the full implementation of EU air directives.
- Less damage for water based eco-systems, such as the Danube Biosphere Reserve, the Black Sea, and the Baltic Sea through improved water quality. The full implementation of the Directive on Discharge of Dangerous Substances to water and Urban Waste Water Treatment Directive should reduce pressures significantly.
- Positive impacts for eco-systems from improved waste management. For example, less emissions of heavy metals and dioxins from incineration and less groundwater pollution from the illegal dumping of waste as well as from untreated waste. This damage can be reduced through the implementation of the Waste Directives.
- Finally, the implementation of the Habitats Directive may help reduce the damage to habitats from encroaching economic activities such as uncontrolled urbanisation in Turkey, intensive logging in the Birzai Forest of Lithuania or intensive agriculture practices on and around the designated protected areas around the Danube Delta.

The significance of these benefits for the candidate countries as a whole is presented in Table 2.

**Table 2. Overview of the Qualitative Benefits from Compliance with each Directive Assessed**

Directive	Overview of Benefits		
	Health Benefits	Resource Benefits	Eco-systems
<b>Air Quality</b>			
Air Quality Framework + daughters: PMs, SO <sub>2</sub> , Pb, NO <sub>x</sub>	***	***	***
Tropospheric Ozone Pollution	**	**	**
VOC-Solvents	**	*	**
Regulation - Ozone-Depleting Substances	*	*	*
Lead Content of Petrol, Quality of Diesel Fuel	***	-	*
<b>Industrial Pollution Control</b>			
Air Pollution from Industrial Plants	Included in IPPC		
Large Combustion Plants	***	**	***
IPPC	***	**	***
<b>Waste Management</b>			
Framework Directive on Waste	**	*	**
Titanium Dioxide and daughters	**	*	*
Municipal Waste Incineration	***	**	**
Hazardous Waste Incineration	***	**	**
Landfill	**	*	**
Disposal of Waste Oils	*	**	**
Disposal of PCBs and PCTs	**	*	*
Sewage Sludge	*	*	*
Batteries and Accumulators	*	*	**
Packaging and Packaging Waste	*	*	**
<b>Water Quality</b>			
Proposed Water Quality Framework	*	*	***
Dangerous Substances to Aquatic Environment	**	**	***
Urban Waste Water	***	**	***
Nitrates from Agricultural Sources	**	**	**
Bathing Water	**	**	**
Drinking Water	**	**	**
Surface Water for Drinking	**	**	**
Ground water	**	**	**
Fish water	**	***	**
Shellfish Water	*	**	**
<b>Nature Protection</b>			
Habitats	-	*	***
Wild Birds	-	*	***

Key: Very Significant Benefits: \*\*\*; Significant Benefits: \*\* ; Some Benefits: \*

### 3. Results: Extent and Value of the Benefits

#### 3.1. Overview

##### *Extent of the benefits*

The implementation of the EU directives in the candidate countries will reduce the pressures on the environment through a reduction in pollution emissions and deposition and, subsequently, diminish their negative impact, for example on public health. The following list gives some examples of the extent of these benefits.

- **Air:** Emissions of particulates from the candidate countries is expected to fall by between 1,8 and 3,3 million tonnes. Without EU directives, emissions would be expected to stand at 3,7 million tonnes in 2010. As regards the impact of these particulates on human health, the study suggests that between 15.000 and 34.000 cases of premature deaths across the candidate countries will be avoided through the implementation of EU air directives in 2010.
- **Water:** Across the candidate countries, households are expected to benefit from improved drinking water. Particular benefits will accrue to those currently without supply, for example between 20% and 30% of all households in Turkey, Bulgaria and Estonia. This includes both benefits of preference such as better taste, colour and smell of water as well as health improvements due to reduced contamination. Similar benefits are expected from improved bathing water quality.
- **Waste:** Methane emissions will, through the Landfill Directive, fall by some 0,6 to 6,4 million tonnes annually by the year 2020<sup>4</sup>. In spite of an estimated 2% growth in waste generation, the Landfill Directive is calculated to lead to a reduction of waste disposed in landfills from around 59 million tonnes in 1998 to between 20 and 35 million tonnes in 2020. The Directive on Packaging Waste will also imply that the amount of waste recycled by all candidate countries will increase by 3,7 million tonnes per year by 2020.
- **Nature:** The size of protected areas, as percentage of total country surface, will increase. This is expected to range from: 26 percentage points (pp) in Slovenia (from 6% of total surface area to 32%), 10 pp in Malta (from 18% in to 28%), 8 pp in Lithuania (from 11% to 19%), and around 2,5 pp in Bulgaria (5% to 7,5%) and Estonia (16% to 18,3%).

##### *Value of benefits*

Where possible and sensible, an economic value has been estimated for these benefits. The overall benefits for the candidate countries, over the period 1999-2020, from implementing EU directives amounts to between 134 and 681 billion € assuming full implementation is achieved in 2010. This corresponds to annual benefits of between 12,5 and 69 billion € (Table A1 in the Annex).

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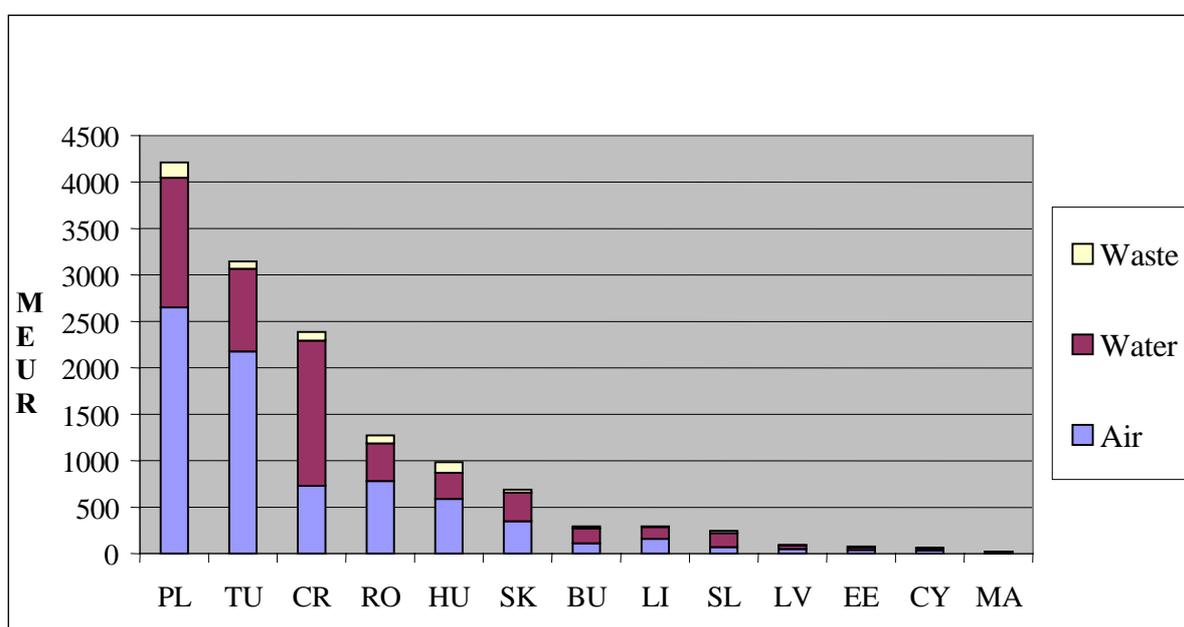
<sup>4</sup> The landfill directive provides for gradual implementation (with staged targets) with all provisions needed to be carried out by 2020. This is why this section uses 2020 rather than 2010 even though full implementation by some countries is possible by 2010.

A single number cannot be given as this would be misleading, the wide range underlines the uncertainty of the value <sup>5</sup>. For the monetary analysis, the study uses the low figure to avoid exaggerating the benefits arising from EU directives.<sup>6</sup>

Reduced air pollution accounts for around half of the total benefits. However, it should be kept in mind that the benefits from water and waste directives are less exhaustively captured by the monetary valuation and that the benefits from nature protection are not covered.

At national level, Poland, Turkey, the Czech Republic and Romania stand to benefit from full implementation the most (in absolute terms, see Figure 1).

**Figure 1 - Annual Value of Benefits for Full Compliance: Lower Estimate**



*(See Table A1 in Annexe for detailed data on annual benefits per media)*

However, when looking at these benefits in relation to the population and GDP of the candidate countries, the picture is a little different. This comparison, presented in Figures 2 and 3 below, indicates that the benefits vary significantly between the countries, ranging from 36 to 273 € per capita in Bulgaria to 232 to 702 € per capita in the Czech Republic.

In terms of GDP, the benefits represent between 0,7% of GDP in Malta and 0,75% in Cyprus to 4,8% of GDP in the Czech Republic. These values indicate the size of the benefits as a proportion of GDP but do not suggest that GDP would rise by a given amount as a result of EU directives<sup>7</sup>.

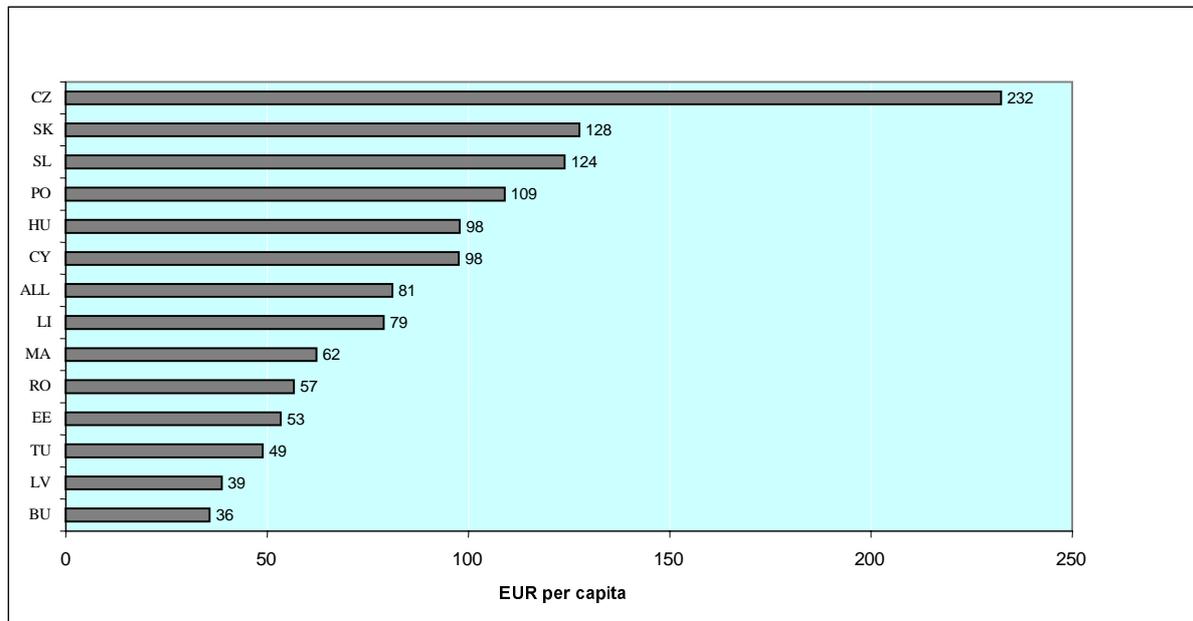
<sup>5</sup> Value of illness, value of early death, cost of global warming are each generally given in large ranges, depending on the method used to estimate them. Similarly, estimates for the value of clear water or clean rivers also tend to be given as ranges.

<sup>6</sup> Given the uncertainties involved, it is of course possible that even this low figure is an overestimate.

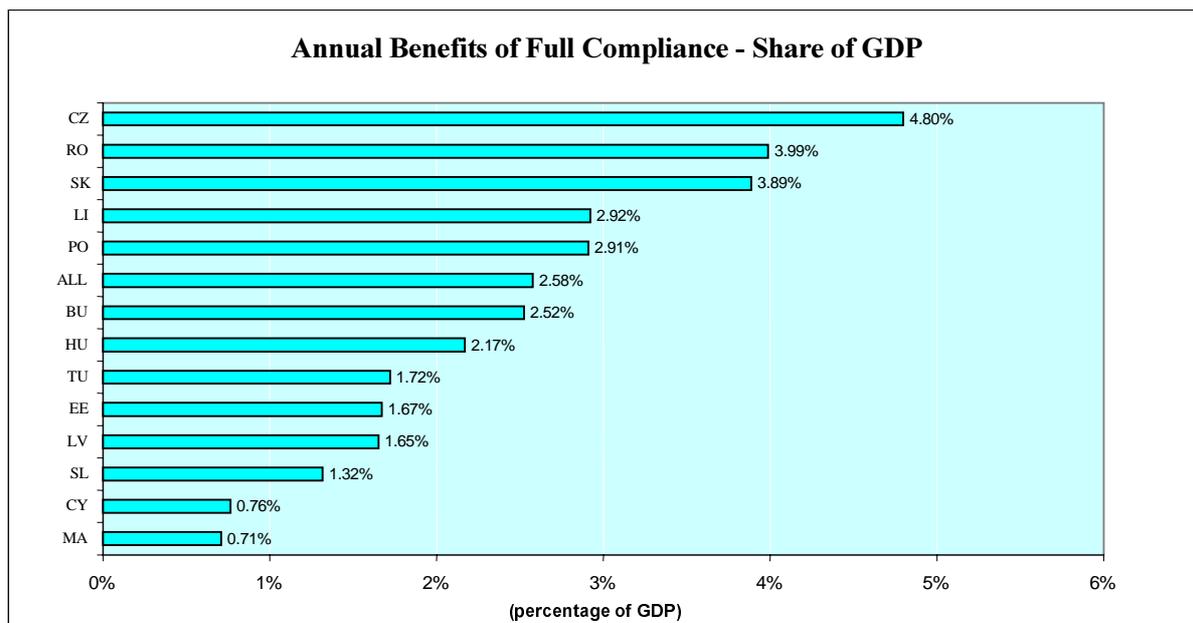
<sup>7</sup> There is one main reason for this. The primary reason is that GDP is an indicator of value added to the economy as given by market values, and not all issues we value are represented by GDP – this includes health,

Notwithstanding these variations, the benefits from EU directives are significant for all candidate countries.

**Figure 2 - Per Capita Annual Benefits from Full Compliance: Lower Estimate**



**Figure 3 - Annual Benefits of Full Compliance as % of GDP: Lower estimate**



long life, appreciation for clean water. In short, GDP is only intended to be an economic indicator, not a full welfare indicator.

## **3.2. Air**

### ***Extent of the Benefits***

The study has assessed the extent of the benefits from lower emissions for the following pollutants: particulates, sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOCs), carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), heavy metals and Tropospheric ozone. The analysis does not cover dioxins, traffic related ozone emissions or methane (CH<sub>4</sub>). The results are therefore underestimated as dioxins and ozone have significant impacts on health and methane is an important greenhouse gas. The main benefits arise from lower emissions of particulates (PM<sub>10</sub>), of the acid gases SO<sub>2</sub> and NO<sub>x</sub>, ammonia (NH<sub>3</sub>) and volatile organic compounds (VOCs). Carbon monoxide and carbon dioxide are considerably less important.

EU directives will reduce the emission of particulates by some 1,8 to 3,3 million tonnes in 2010. By that year, total emissions of particulates are expected to range from 0,4 to 1,8 million tonnes, with full implementation. Without implementation of EU directives, this would amount to 3,7 million tonnes. This reduction will reduce the risk of respiratory diseases (e.g. bronchitis, asthma), hospitalisation and premature deaths. The study suggests that between 15.000 and 34.000 cases of premature deaths will be avoided every year across the candidate countries through full implementation of EU directives in 2010.

Without EU directives, total SO<sub>2</sub> emissions of the candidate countries are expected to stand at some 7 million tonnes in 2010. Full implementation of the EU Directives (not taking into account the currently discussed new Large Combustion Plant Directive) will reduce these emissions to some 4 to 5 million tonnes. Likewise, NO<sub>x</sub> emissions are expected to fall from around 3 million tonnes in 2010 to 2 million tonnes through compliance with EU directives. This reduces the damage to buildings, crops as well as the incidence of respiratory diseases.

Some examples of these benefits include:

- Between 43.000 and 180.000 cases of chronic bronchitis will be avoided in 2010 through the full implementation of EU air directives. A large number of these relate to Turkey, primarily due to the use of low quality lignite in power stations.
- As mentioned above, between 15.000 and 34.000 cases of premature deaths can be avoided through improved air quality. Poland is expected to benefit the most, with between 7.000 and 14.000 fewer cases in 2010.
- Building surfaces “age” less quickly when they are not exposed to SO<sub>2</sub> emissions. For example, lower air emissions should reduce the building surface of the Czech Republic needing maintenance by some 2,6 million square meters in 2010.
- Crop yields can increase when exposed to less SO<sub>2</sub> - for example, the implementation of the EU Directives may result in a 5% increase in the yield of wheat in Bulgaria in 2005.

### ***Value of the benefits***

The benefits from reduced mortality, incidence of diseases, damages to building and crops arising from the full implementation of EU directives are estimated to be worth between 8 and 44 billion € in 2010 for the candidate countries.

When taken over the period 1999-2020, the benefits from improved air quality amount to some 75 to 430 billion € in net present value terms (Table A3 in Annex). Poland accounts for about one third of these benefits. There, avoided costs are expected to amount to between 2,7 and 15,5 billion € in the year 2010.

The benefits arise primarily from lower emissions of particulates, the acidic pollutants SO<sub>2</sub> and NO<sub>x</sub>, volatile organic compounds (VOCs) and ammonia (NH<sub>3</sub>). The reductions in these five pollutants account for over 95% of the value of total benefits. Reductions in carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>) account for a very small fraction of the total benefits. It should be noted, however, that the very low values for CO are a consequence of the lack of clear data of its impact on health. However, these are increasingly recognised to be significant and the benefits are therefore likely to be underestimated. For CO<sub>2</sub>, there is similarly a growing awareness of the possible extent of these impacts, but also a lack of data. The importance of these two pollutants is therefore expected to grow in future studies.

### ***Cross border issues***

The benefits discussed so far are domestic. In other words, they accrue to the candidate country that carries out the necessary actions to implement the EU directives. However, there are also very positive impacts for other countries, including the EU. Some examples of these transboundary effects are given below:

- Benefits for the candidate countries resulting from less air pollution from other candidate countries through their implementation of EU directives amount to 1,7 billion € annually, according to the low estimate<sup>8</sup>.
- Some candidate countries benefit significantly from actions in other countries. This is the case of Poland, where between one tenth and one quarter of the total benefits from reduced air pollution result from actions in other candidate countries, while in Hungary, the contribution of actions taken by other countries accounts for around half of the total benefits.
- Domestic actions lead to very significant benefits to neighbouring countries. In many cases, these are several times larger than the domestic benefits. For example, Polish initiatives for complying with EU air directives will lead to between 2,5 and 11,8 billion € in benefits for Poland but between 4,1 and 24 billion € in benefits to other countries.
- The EU would benefit significantly from lower emissions of air pollutants from the candidate countries and their implementation of EU Directives. This would amount to 6,5 billion € annually according to the low estimate. As an example, the EU benefits between 1.7 to 10 billion € per year from Polish compliance with EU air directives.
- The total benefits accruing to non-EU third countries (notably Ukraine, Belarus and Russia) from actions by the candidate countries to meet the requirements of EU directives would stand at 9.5 billion € per year, again applying the low estimate.

These figures underline the benefits for the whole of Europe from the accession of the candidate countries to the EU and their implementation of EU environmental directives.

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<sup>8</sup> Turkey not included.

### 3.3. Water

The study has assessed the extent and value of the following benefits:

- Benefits from the availability of drinking water and its improved quality.
- Recreational benefits from cleaner coasts, lakes and rivers for bathing.
- Benefits to eco-systems from less pollution into water as well as benefits from improved quality of water resources that are used for commercial purposes.
- Transboundary benefits are reflected to a certain extent, given that all candidate countries are included in the analysis.

Given data availability, the study has not included the following benefits:

- Benefits to industrial abstractors, agriculture and aquaculture, although these are likely to be significant.
- Benefits to EU Member States.

#### *Extent of the benefits*

Households are expected to benefit from access to drinking water quality as well as from its improved quality. As an example:

- In Turkey, around 6 million households (29%) are expected to benefit from new connection to drinking water.
- In Bulgaria and Estonia, these values are similarly high (25% and 30% of all households respectively), while in other countries, a lower share of all households benefit.
- For households already connected, there will be significant benefits from improved drinking water quality.

#### *River quality*

The implementation of EU directives will significantly improve the quality of rivers in the candidate countries.

- In Bulgaria, 23 rivers are of 'good' quality, 18 of 'fair' quality, the rest is of either 'bad' or 'very bad' quality. After compliance with EU water directives, 41 rivers are expected to be of 'good' and 59 of 'fair' quality. In the other candidate countries, similar results are expected.
- The Czech Republic has the biggest river length of all the candidate countries (76.000 km). At the same time, not a single river is of 'good' quality. 10% are of 'fair' quality, 10% of 'very bad' quality, while the remaining 80% are of either 'poor' (40%) or 'bad' (40%) quality<sup>9</sup>. Compliance with EU water directives will improve this situation considerably: 10% are expected to be of 'good' quality, and all rivers of 'poor', 'bad' or 'very bad' quality are expected to improve to fair quality after successful implementation.

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<sup>9</sup> This applies the Czech Republic's classification of water quality. According to this classification, "poor" quality is better than "bad" quality.

### *Recreational use of water*

- The implementation of the Urban Waste Water Treatment Directive will lead to an improvement in the quality of coastal waters, rivers and lakes, particularly as result of reduced eutrophication following better treatment of waste water. Discharges of nutrients are expected to fall by between 33% in the Czech Republic to 67% in Poland and phosphorous discharges from 38% in Slovenia to 71% in Poland. This creates better opportunities for recreational activities, including tourism, as well as reducing danger to fish stocks.

### ***Value of the Benefits***

#### *Drinking Water*

- New connections and cleaner drinking water resulting from EU water directives has an estimated value of 500 million to 8,7 billion € a year. This is based on the overall demand for clean drinking water. The demand in Turkey accounts for around a third of the total value (150 to 2.650 million € a year).

#### *Bathing and other surface water quality*

The benefits from a better quality of bathing water are estimated at around 2,5 billion € a year. Similarly, this is based on the demand for clean bathing water.

#### *Improved river quality*

The willingness to pay for an improvement of river quality from 'poor' to 'fair' and from 'fair' to 'good' is estimated at 2 billion € a year across the candidate countries. This estimate excludes the benefits from direct use, for instance for recreation. The Czech Republic accounts for more than half of this sum, or 1.2 billion € a year.

### ***Total Value of Benefits***

The total value of the benefits from implementing EU water directives across the candidate countries lies in the range of 5 to 14 billion € a year.

## **3.4. Waste**

The EU Waste Directives will lead to major changes in handling, treatment and disposal of waste in the candidate countries. The candidate countries have a wide range of ways in which they can choose to implement the set of waste Directives. For example, they can choose to give priority to recycling or to incineration. This choice will affect the extent and value of the benefits arising from each Directive. It is therefore not always possible to identify exactly what will occur as a consequence of a specific Directive.

The main benefits from implementing the Waste Directives are:

- Lower pollution to groundwater and surface water from leakage of unprotected landfills and, as a result, lower risks of contaminating drinking water.
- Reduced health and explosions risks as well as lower impact on global warming as methane emissions from landfills are captured and made to generate energy. Existing landfill sites will have to be upgraded and illegal dumping sites closed.

- Benefits to eco-systems and other environmental resources as emissions from waste activities into air, water and soil are reduced and the recovery of energy is increased through the Incineration Directive.
- Increased efficiency in the use of material and reduced production of primary material as a result of higher levels of recycling. This is a result of the targets of the Packaging Directive as well as diversion targets from the Landfill Directive.
- Lower costs for waste collection, treatment and disposal as less waste will be produced.
- Better management and monitoring of waste streams through the Waste Framework Directive.

EU waste directives will help avoid:

- Pollution into air, soil and water (methane, CO<sub>2</sub>, particulate, heavy metals from sewage sludge, PCBs/PCTs, waste oil) and ecological risks from waste treatment sites and hazardous waste.
- Respiratory diseases and noise nuisance to local population, risks to health from contaminated water supplies, air and soil.

#### **Extent of the benefits**

- The full implementation of the Landfill Directive will lead to a reduction of methane emissions (captured) of between 0,6 and 6,4 million tonnes annually by the year 2020.<sup>10</sup>
- In spite of a 2% growth in waste generation, the Landfill Directive is estimated to reduce the waste disposed in landfills from some 59 million tonnes in 1998, to around 35 million tonnes by 2020 if the candidate countries grant priority to recycling and around 20 million tonnes if incineration is chosen as the preferred option.
- In light of the Packaging Directive, recycling levels will, by the year 2020, have increased by 1,6 million tonnes for paper, around 39.000 tonnes for aluminium, and for all the recyclables together, around 3,7 million tonnes.

#### **Value of the benefits**

The value of the benefits from EU waste directives (Directives on Landfill and Packaging Waste) have been estimated for all candidate countries. This is based on two scenarios, one with a maximum level of recycling and the other with a maximum level of incineration, giving benefits with a lower and a higher bound for each scenario.

The total annual benefits from full compliance with the Landfill and Packaging Directives were estimated to be higher under the scenario with a maximum level of recycling. In this case, they range from 1,3 to 12,3 billion € a year. Under the scenario with maximum incineration, the benefits stand at some 0,6 to 8,7 billion € a year. Across all scenarios, benefits from EU waste directives range at 0,6 to 12,3 billion € a year. The implementation of the Landfill Directive contributes with the largest share of these benefits.

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<sup>10</sup> As noted above, the landfill directive provides for gradual implementation (with staged targets) with all provisions needed to be carried out by 2020. This is why this section uses 2020 rather than 2010.

*Landfill Directive:* For all of the candidate countries, complying with the Landfill Directive by adopting a maximum level of recycling should lead to larger benefits than maximising incineration. Benefits for all countries amount to between 1,1 and 10,9 billion € a year for the recycling scenario against 0,4 to 7,3 billion € a year for incineration. In reality, the candidate countries are likely to adopt some sort of middle ground between the two extreme scenarios of maximum recycling and maximum incineration. At country level, the highest annual benefits accrue to Hungary (0,15 to 1,7 billion €), Poland (0,25 to 2,5 billion €) and Romania (0,2 to 2,6 billion €).

*Packaging Directive:* Total benefits from the Packaging Directive range from 156 to 910 million € a year for all candidate countries taken together. This relates to the benefits from avoided environmental damage by using secondary materials (e.g. recycled paper, aluminium and glass) instead of more primary materials. The largest annual benefits are experienced by Hungary (10-107 million €), Poland (35-191 Million €) and the Czech Republic (22-148 million €).

*Incineration Directive (Czech Republic only):* Incineration gives lower benefits. This is clearly illustrated by the example of the Czech Republic for which benefits from complying with the EU incineration directives ranges from 3 to 22 million € a year. This is only around 13% of the Czech Republic's benefits from the Packaging Directive.

### **Nature Conservation**

The benefits arising from the implementation of EU directives on nature conservation are mainly related to the setting-up of the Natura 2000 Network of special conservation areas in the candidate countries. Biodiversity and ecosystems will also benefit from other directives of the EU environmental legislation, for example through better air and water quality, but these are not covered in this section.

The main threats to ecosystems and bio-diversity in the candidate countries are:

- Acid rain and soil pollution from industry.
- Practices in agriculture, hunting, fishing and forestry that do not take environmental concerns into account.
- Construction linked to infrastructure (e.g. roads) and human settlements.

Implementing the Habitats and Wild Birds Directives will help address some of these problems by:

- In many cases, increasing the surface of protected areas.
- Raising the level of protection within existing protected areas.
- Identifying species to be protected.
- Adopting specific protection measures against identified threats faced by each designated area (e.g. forbidding pesticide use, increasing enforcement).

### **Extent of benefits**

From 1997 to 2020, the size of protected areas (as a percentage of each country's total surface) is expected to increase. Some examples include:

- Bulgaria: + 2,5 percentage points, from 5 % to 7,5% of Bulgaria's total surface.
- Estonia: + 2,3 percentage points, from 16% to 18,3% of Estonia's total surface.
- Lithuania: + 8 percentage points, from 11% to approximately 19% of Lithuania's total surface.
- Malta: + 10 percentage points, from 18% to about 28% of Malta's total surface.
- Slovenia: + 26 percentage points, from 6% to 32% of Slovenia's total surface.

The second major benefit is the protection of threatened species. In the candidate countries, these species, in particular mammals, represent a substantial part of the countries' total species population.

Examples include:

- 19% in Romania,
- 15% in Turkey,
- 14% in Slovenia;
- 12% in Poland;
- 7,4% in Lithuania.

EU directives on nature protection will provide better protection for these species.

## 4. Conclusions

### 4.1. Summary Conclusions

This study has highlighted and assessed the range of benefits that the implementation of EU environmental directives will bring to the candidate countries. The key results show that:

- There are very significant benefits to be gained by all candidate countries from fully implementing EU directives. For example, fully implementing the EU Directives related to air quality can lead to between 15.000 and 34.000 fewer cases of premature deaths from exposure to air pollution, and between 43.000 and 180.000 fewer cases of chronic bronchitis.
- When taken all together, the annual value of these benefits ranges between 12 and 69 billion €. This corresponds to between 80 and 410 € per capita. Over the time period until 2020, the cumulative benefits amount to between 134 and 681 billion €. Given all uncertainties with these figures, it is important, to take the lower figure in this range as the main result of the study. Even when the lower figure is used, the study clearly suggests that the value of benefits is significant and that the importance of the benefits could usefully be explored in more detail for key decisions in the candidate countries.
- Improved air quality, resulting from the implementation of EU directives, accounts for around 55% of the total value of these benefits. The benefits from reducing air pollution relate mainly to improved public health through fewer respiratory diseases and, most importantly, fewer cases of premature deaths. There are also significant benefits from a reduced burden on agricultural crops and avoided damages to buildings.
- The benefits of EU directives do not only accrue to the candidate countries. Reductions in trans-boundary air pollution will yield significant cross-border and trans-national benefits. The main results are:<sup>11</sup>
  - Benefits from domestic actions amount to around 6 billion €. Domestic benefits from actions by other candidate country add a further 1.7 billion €. <sup>12</sup>
  - Total benefits from actions by the candidate country for other countries amount to 16 billion € a year. The EU Member States benefit 6.5 billion € and other countries, notably the Ukraine, Belarus and Russia, some 9.5 billion € a year.
- The benefits from implementing the EU's water related directives include improved access to clean drinking water, bathing water and rivers. Around 10 million households are expected to benefit from new connection to drinking water. In several candidate countries, this covers 20% to 30% of all households. River quality will improve, for example with the number of "good" quality rivers more than doubling in Bulgaria. The value of these benefits, together with benefits of increased recreation from cleaner surface waters, amount to around 5 to 14 billion € a year.
- The benefits from implementing EU waste directives include reduced methane emissions, which benefit public health and global warming and a reduced impact on the environment through increased recycling and the lower use of primary materials. The level of recycling is likely to

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<sup>11</sup> All applying the lower estimate of benefits.

<sup>12</sup> Turkey not included.

increase by around 3,7 million tonnes – or on average around 22 kg per capita. The reduction in methane emissions should be between 1 and 6 million tonnes per year. The value of the waste related benefits ranges from 1 to 12 billion € a year, with the benefits likely to be higher under the maximum recycling scenario than under the incineration scenario.

- In the case of nature conservation, EU directives would secure protection of many thousand hectares of valuable habitats and hundreds of endangered species, especially endemic species.

In addition, many benefits of EU directives have not been fully covered when assessing the monetary values. This includes the protection of sensitive ecosystems and bio-diversity. Some environmental investments might also lead to benefits not directly related to the environment. They can improve economic efficiency and boost productivity, for example by facilitating the take-up of modern technology, by lowering production and maintenance costs for companies through better water quality and by providing savings in the form of more efficient waste management.

From this range of benefits, three key conclusions can be drawn:

- Implementing the EU environmental directives can help *improve the health and quality of life for citizens* across the candidate countries, and to a certain extent, for citizens of the EU.
- *Co-operation across candidate countries* is crucial to maximise the transboundary benefits from reducing air pollution.
- In narrow monetary terms, the assessed *benefits are likely to be of the same order of magnitude if not larger than the costs* of implementing EU directives. However, this result should be treated with caution as there is considerable uncertainty for estimates both of benefits and costs.

#### **4.2. Interpretation of results: Health warning!**

The study does not suggest that the money value for the benefits of EU directives is the final measure of these benefits. Nor do the authors mean to imply that these benefits can really be equated to money. There are significant ethical and methodological concerns that should be taken into account.

The ethical concern is clear: Some object as a matter of principle to giving illness, life and damage to eco-systems an economic value. A general response is that people naturally make trade-offs between the environment and their economies. The aim of the monetary value is to identify the choice that people want and to demonstrate that there are real benefits to be had from implementing EU directives in the candidate countries.

The methodological concern is also clear: only some benefits have been taken into account; there are data limitations, difficulties in assessing future economic growth and increasing environmental pressures, and also limitations of the methods used<sup>13</sup>. This underlines the fact that no single figure can be given, and that broad ranges are needed for an honest analysis. However, the meaning of the range can be taken seriously, although the reader should be aware that the true value might be outside the range given here. Furthermore, given the uncertainty in the numbers, it is important to focus on the lower value when drawing conclusions regarding implications of the study.

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<sup>13</sup> This includes the fact that the approach “transfers” practice from the EU and USA to the candidate countries – implicitly assuming that the health response to a given pollution dose is the same in all countries. The transfer of economic values is treated by using purchasing price parities, but even this is an approximation.

### 4.3. Policy Recommendations

The results and discussion above have a number of implications for the environmental policy of the candidate countries in the context of their accession to the EU.

- i) The benefits assessment suggests that there could be significant benefits from EU environmental directives that have not always been fully taken into account when taking decisions on transposing and implementing these directives. The scale of the benefits suggests that this aspect should be integrated into decisions on implementation planning. This may lead to the conclusion that the candidate countries' current efforts for implementing EU environmental directives should be maintained, if not strengthened.
- ii) The total benefits resulting from EU directives are higher if their implementation is accelerated. This is because the benefits would start to accrue earlier given earlier reductions in emissions, improvements in air and water quality and waste management practices.
- iii) The benefits are not confined to specific elements of the environmental legislation, the full set of Directives is important in generating benefits. The inter-relations between Directives are strong and the implementation of several of them is needed to ensure full benefits. The implementation plans could valuably reflect this by ensuring that all Directives are looked at and that the dangers of prioritising only a small subset of Directives are avoided.
- iv) While it is possible to do broad cost-benefits analyses of EU directives, the implementation programmes should ensure that they are not only driven by such considerations because this might exclude other equally important issues that are difficult to quantify in monetary terms. This includes, among others, many important social benefits such as bio-diversity. The monetary assessment should be taken as a strong indicator and a tool. However, other types of benefits should also be given due consideration.
- v) The environmental benefits will be enhanced if the implementation of other policy areas such as agriculture, transport and energy takes into account environmental concerns and integrates the principle of sustainable development. Similarly, the implementation of the other policy areas could usefully take on board the knowledge of the likely benefits associated with environmental measures.

In short, this analysis, by highlighting, assessing and valuing the benefits of compliance with the body of EU environmental directives has demonstrated the interest to the candidate countries and to the EU of ensuring that the environmental legislation is given the priority it deserves.

## **DATA ANNEXES**

**Table A1: Annual Benefits of Full Compliance, by Media, by Candidate Country (Million €)**

	<i>Annual Benefits of Full Compliance (million €)</i>							
	<b>Air</b>		<b>Water</b>		<b>Waste</b>		<b>Total</b>	
Country	Low	High	Low	High	Low	High	Low	High
Bulgaria	110	1130	160	435	20	680	290	2240
Cyprus	30	140	25	100	8	75	65	310
Czech Republic	730	3600	1560	2475	95	1150	2390	7220
Estonia	40	210	27	100	10	180	75	490
Hungary	590	4100	280	1080	115	1900	985	7080
Latvia	50	320	40	140	5	110	95	570
Lithuania	160	820	125	280	6	205	290	1300
Malta	8	40	13	47	3	40	24	130
Poland	2650	15400	1400	3280	165	2750	4210	21400
Romania	780	5850	405	1250	85	2650	1270	9800
Slovakia	350	2250	305	680	30	440	690	3370
Slovenia	70	475	150	350	25	290	240	1120
Turkey	2180	9700	880	3400	77	1850	3140	14950
<b>All Candidate Countries</b>	<b>7700</b>	<b>44000</b>	<b>5380</b>	<b>13600</b>	<b>650</b>	<b>12300</b>	<b>12500</b>	<b>69300</b>

*Note: Total may not add to the sum of the parts given rounding.*

*These values relate to the full benefits to the candidate countries - from both own action and as a result of other candidate countries implementing the EU directives, with the exception of Turkey for which only benefits from domestic actions are covered.*

*It would be misleading to present a single central estimate as this would implicitly suggest a very accurate knowledge of the relationship between pollutant, impact and monetary benefit. Hence, the lower and upper bounds reflect the bounds of confidence in the results given methodological uncertainties.*

**Table A 2: Annual Benefits of Full Compliance  
By Candidate Country Per Capita & as Percentage of GDP**

<i>Candidate Countries</i>	<i>Ratios of Annual Benefits of Full Compliance</i>			
	<i>Benefits Per Capita (€)</i>		<i>Benefits as % of GDP</i>	
	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>
Bulgaria	36	273	2,5%	19,3%
Cyprus	98	471	0,8%	3,7%
Czech Republic	232	702	4,8%	14,5%
Estonia	53	340	1,7%	10,7%
Hungary	98	703	2,2%	15,6%
Latvia	39	233	1,7%	10,0%
Lithuania	79	353	2,9%	13,1%
Malta	62	329	0,7%	3,7%
Poland	109	553	2,9%	14,8%
Romania	57	436	4,0%	30,7%
Slovakia	128	624	3,9%	19,0%
Slovenia	124	563	1,3%	6,0%
Turkey	49	233	1,7%	8,2%
All Candidate Countries	81	412	2,6%	13,1%

*Note: It would be misleading to present a single central estimate as this would implicitly suggest a very accurate knowledge of the relationship between pollutant, impact and monetary benefit. Hence, the lower and upper bounds reflect the bounds of confidence in the results given methodological uncertainties.*

**Table A3: Total Benefits over the Benefit Period (until 2020), by Media, by Candidate Country**  
*(Net Present value, assuming: 2010 full Implementation Period, 4% Discount Rate) (Million €)*

	<b>Present Value (million €)</b>							
	<b>Air</b>		<b>Water</b>		<b>Waste</b>		<b>Total</b>	
	Low	High	Low	High	Low	High	Low	High
Bulgaria	1070	11000	1580	4200	195	6620	2850	21800
Cyprus	290	1400	260	960	75	730	630	3050
Czech Republic	7100	35050	15230	24050	925	11200	23260	70300
Estonia	390	2050	260	985	95	1750	750	4780
Hungary	5740	39920	2720	10490	1120	18500	9590	68900
Latvia	485	3120	380	1340	50	1070	915	5500
Lithuania	1555	7980	1230	2750	55	2000	2840	12750
Malta	75	390	125	460	30	390	230	1250
Poland	25800	149930	13590	31960	1600	26300	41000	208200
Romania	7590	56950	3960	12150	825	26300	12380	95400
Slovakia	3400	21900	3000	6610	290	4280	6700	32800
Slovenia	680	4620	1470	3440	240	2820	2400	10900
Turkey	21220	94440	8640	33200	750	18000	30600	145600
<b>All Candidate Countries</b>	75400	428700	52400	132600	6270	112000	134000	681000

*Note: Total may not add to sum of the parts given rounding*

*It would be misleading to present a single central estimate as this would implicitly suggest a very accurate knowledge of the relationship between pollutant, impact and monetary benefit. Hence, the lower and upper bounds reflect the bounds of confidence in the results given methodological uncertainties.*