# INTELLIGENT PERMITTING FOR AIR AT SPECIFIC SITES

# The i-PASS Concept

## Aligning the Local Permitting Process with Overarching EU Legislation

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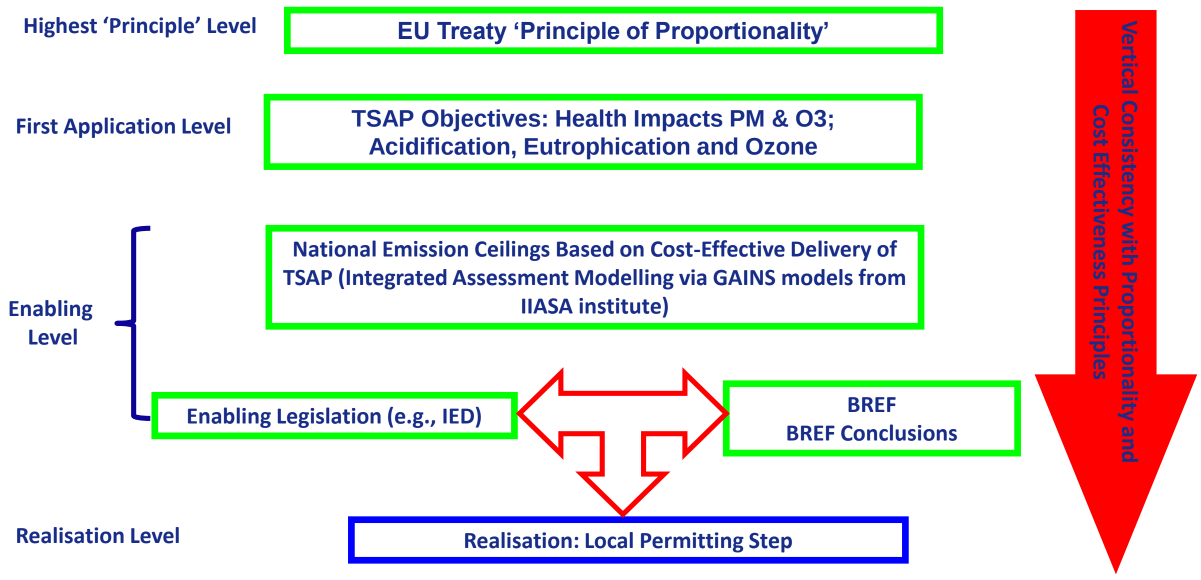
# 1. INTRODUCTION

For more than two decades, both in the context of the UN-ECE Convention on Long Range Transport of Air Pollutants (CLRTAP) and the European Union, European Air policy has largely been developed using an 'effects based' approach. Examples of these are: the UN-ECE Oslo Protocol (or Second Sulphur Protocol); the Gothenburg Protocol (the first multi-pollutant-multi-effects based approach in Europe); the Clean Air For Europe Programme (CAFE) resulting in the EU Thematic Strategy on Air Pollution (TSAP) and, most recently the EU revised TSAP and associated Air Policy Package, released in December2013.

In each case, the approach has been based on identifying the level of burden in each country (e.g. emission reductions) to enable the policy ambition (a set of health and environmental improvement targets) to be achieved at the lowest cost burden to the EU or Parties to CLRTAP, as a whole.

While instruments like the Gothenburg Protocol and the parallel EU National Emission Ceilings Directive (NECD) set individual country emission ceilings on a cost-effectiveness basis, the implementation of measures to reduce emissions, at least in the case of industrial installations, is realised through 'local permitting' under the Industrial Emissions Directive (IED). This poses the key question as to how the cost-effectiveness principles used to allocate the ceilings (by pollutant and Member State) can be preserved and applied in the local permitting process. Unless vertical alignment from TSAP to NECD to local permitting is achieved, the principle of cost effectiveness used in designing these overarching legislative instruments will not be realised in practice.

FIGURE 1: THE RELATIONSHIP BETWEEN OVERARCHING EU LEGISLATIVE INSTRUMENTS, ENABLING LEGISLATION AND LOCAL PERMITTING FOR EMISSION TO AIR


Highest 'Principle' Level

EU Treaty 'Principle of Proportionality'

First Application Level

TSAP Objectives: Health Impacts PM & O3; Acidification, Eutrophication and Ozone

Enabling Level

National Emission Ceilings Based on Cost-Effective Delivery of TSAP (Integrated Assessment Modelling via GAINS models from IIASA institute)

Enabling Legislation (e.g., IED)

BREF
BREF Conclusions

Realisation Level

Realisation: Local Permitting Step

Vertical Consistency with Proportionality and Cost Effectiveness Principles

This essential 'vertical alignment' is depicted in Figure 1 above. The highest principle level is the EU treaty itself which sets forth the principle of proportionality. The principle of proportionality is binding with regard to any action of the Community (Article 5 of the EU Treaty). According to the European Court of Justice case law, the principle of proportionality requires *"that measures taken by the Community institutions should be appropriate to achieve the objective pursued without going beyond what is necessary to that end"*. This end is partly realised in the adopting of the cost-effectiveness principle which underpins the TSAP and NECD. However, for this to be realised in practise (the realisation level in Figure 1) the same principle needs to underpin the local permitting process. The following section sets out how this alignment can be achieved.

# 2. ALIGNING THE LOCAL AIR PERMITTING PROCESS WITH OVERARCHING EU LEGISLATIVE INSTRUMENTS (TSAP AND NECD) – The i-PASS Concept

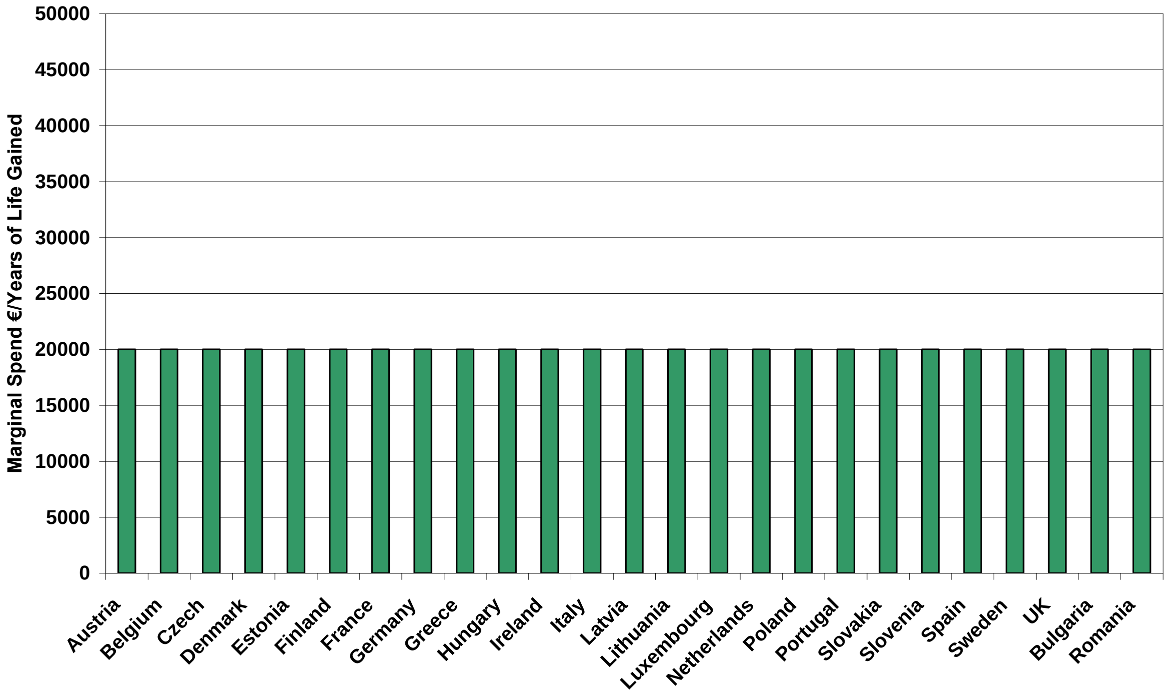
## 2.1 A LEVEL PLAYING FIELD: WHAT DOES THIS MEAN FOR AN ‘EFFECTS DRIVEN’ VERSUS A ‘TECHNOLOGY DRIVEN’ APPROACH?

### 2.1.1 THE EFFECTS DRIVEN APPROACH

As outlined in the introduction, both in the context of the UN-ECE convention on long range transport of air pollution and EU air related legislation, the overarching legislative instruments designed to address concerns over the impact of emissions to air over the past two or more decades have been based on a commitment to the so-called effects driven approach. Here we set out the essential elements that underpin this approach and compare and contrast it to the main alternative, the ‘technology driven’ approach.

First we need to understand the fundamentals of how burden sharing works within an optimised ‘effects driven’ approach. Here, at any ambition level (dimensioned by an overall reduction in impacts for the EU as a whole) the level playing field is when every Member State spends the same monetary amount per unit of impact reduction.  This allocation of burden sharing also results in the lowest overall monetary burden to the EU as a whole; this is the optimised delivery of the improvement target.

FIGURE 2: THE LEVEL PLAYING FIELD FOR AN EFFECTS DRIVEN APPROACH

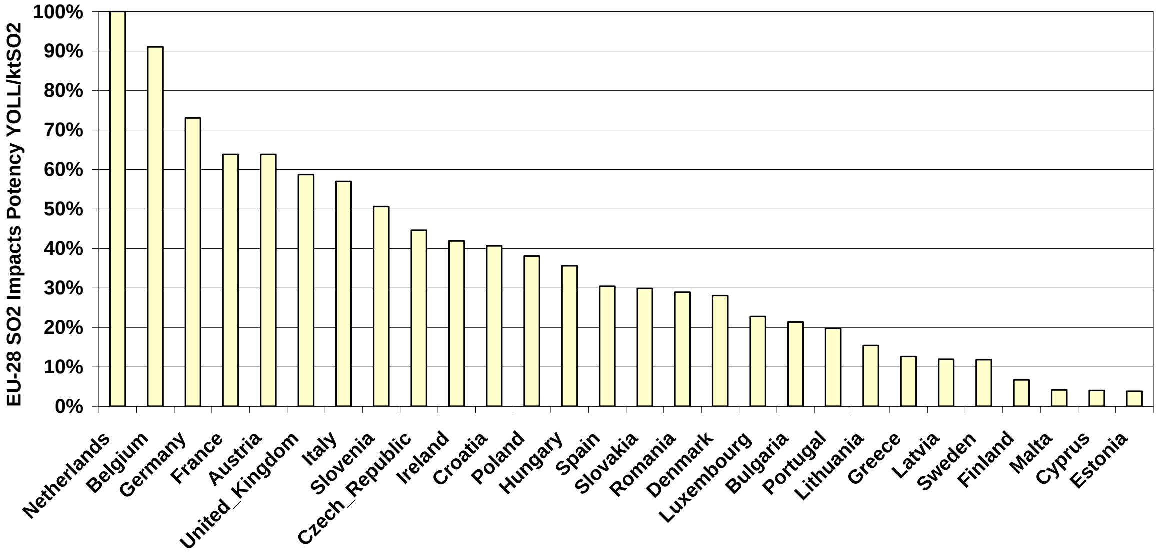


This is depicted in Figure 2 above for the case of PM2.5 impacts reduction in the EU as a whole. In this case the units are marginal spend (in €) per year of life gained.

It is worth noting that in this ‘PM impacts only’ focussed case; this is exactly equivalent to attributing the same Value of a Life Year in each Member State such that the valuation of marginal benefits equals the marginal expenditure on abatement measures. It is also worth noting that when this 'level playing field' is applied, the cost for the EU as a whole to achieve any given ambition level is minimised (optimal).

Second, we need to understand that the impact of a unit of emissions (emission potencies) varies significantly between individual Member States. For $SO_2$, the variation in emission potencies for PM2.5 impacts on statistical life expectancy across the EU Member States is given in Figure 3 below. The individual country potencies (expressed as total statistical years of life lost over the whole EU population (YOLL)/kiloton of $SO_2$ emitted) are normalised to the highest country potency of the Netherlands. To illustrate the significance of the variations, 1kt of SO2 emitted in Spain has only 30% of the impact on the EU population as 1kt emitted from the Netherlands. In the case of Finland, 1kt has only 7% of the impact on the EU population as 1kt emitted in the Netherlands.

## FIGURE 3: VARIATION IN $SO_2$ EMISSION POTENCIES FOR PM2.5 IMPACTS ACROSS EU MEMBER STATES (UNDERPINNING SOURCE: IIASA GAINS MODEL)



This has profound implications for optimised burden sharing for a given impact improvement target. As set out above, in an effects based approach, the cost to the EU as a whole are minimised when the marginal spend per unit reduction in impact is equal across all the Member States at a given ambition level. In the example of PM impacts this means the Δ€/ΔYOLL in each MS are the same. This allows us to set out the following two simple relationships in any two Member States:

For MS1, Marginal Abatement Cost, $€/kt_{abated} = €/YOLL*YOLL/kt_{MS1}$ (1)

For MS2, Marginal Abatement Cost, $€/kt_{abated} = €/YOLL*YOLL/kt_{MS2}$ (2)

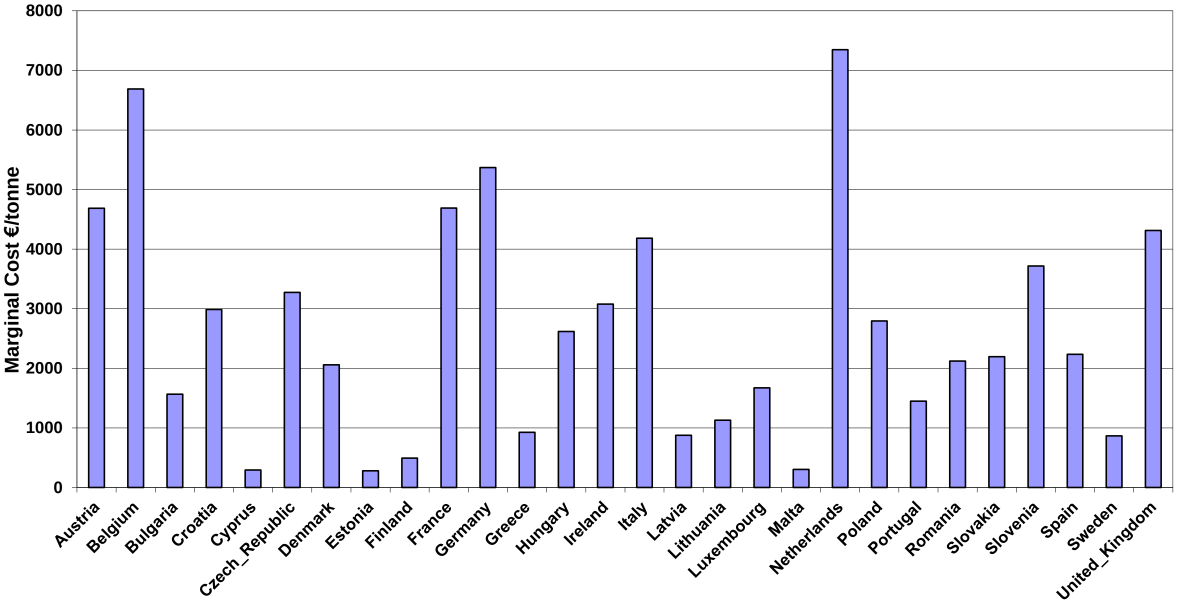
Noting that for an optimised allocation of burden across MSs the value of €/YOLL is the same in each MS (as in Figure 2) we can divide equation (1) by equation (2) to express the ratio of marginal spend on abatement costs between two MS, thus:

$[€/kt_{abated}(MS1)]/[€/kt_{abated}(MS2) = [YOLL/kt_{MS1}]/[YOLL/kt_{MS2}]$ (3)

What equation (3) shows is that the ratio of Marginal Abatement Costs between any two MS to achieve the optimised (least cost) delivery of the environmental ambition occurs when this ratio equals the ratio of the emissions impact potencies between the same two Member States. So if we take the same three country examples from Figure 3 above: The ratio of marginal abatement costs[1] for $SO_2$ between Spain and the Netherlands, at any ambition level, should be 30%. So if the marginal abatement cost in the Netherlands is 7000€/t$SO_2$, then the corresponding value in Spain would be 2100 €/t. Between Finland and the Netherlands the ratio would be 7% resulting in marginal abatement costs for Finland of 490€/t$SO_2$. The values of marginal $SO_2$ abatement costs for all EU-28 Member States, based on their specific $SO_2$ emission potencies are given in Figure 4 below.

Figure 4 shows very significant variations in the marginal spend on abatement costs across the EU. This is a direct outcome of adopting an effects driven approach that looks to allocate burdens between MS in an optimised manner, i.e. achieve the target at the minimum cost to the EU as a whole. This has important implications for local permitting as discussed later.

FIGURE 4: VARIATION IN $SO_2$ EMISSION ABATEMENT COSTS ACROSS EU MEMBER STATES FOR AN OPTIMISED EFFECTS DRIVEN APPROACH TO REDUCING PM2.5 HEALTH IMPACTS



## 2.1.2 THE TECHNOLOGY DRIVEN APPROACH

Before moving on to illustrate the compelling economic case for an effects driven approach, it is worth examining the implications of burden sharing based on the more common concept of 'level playing field' where the same level of abatement is implemented in all MS. This is sometimes referred to as 'the European-wide BAT concept'. Here, as a simple surrogate for this approach, we will explore the implications of an equal marginal spend per unit of emissions abated in each Member State i.e. the same €/tonne abated.

Figure 5 below shows the example explored which assumes a common marginal spend on abatement costs of €5000/tonne pollutant abated. Restating equations (1) and (2) but rearranging gives:

$$\text{For MS1, } €/\text{YOLL} = [€/\text{kt}_{\text{abated}}]\,/[\text{YOLL}/\text{kt}_{\text{MS1}}] \qquad (4)$$

$$\text{For MS2, } €/\text{YOLL} = [€/\text{kt}_{\text{abated}}]\,/[\text{YOLL}/\text{kt}_{\text{MS2}}] \qquad (5)$$

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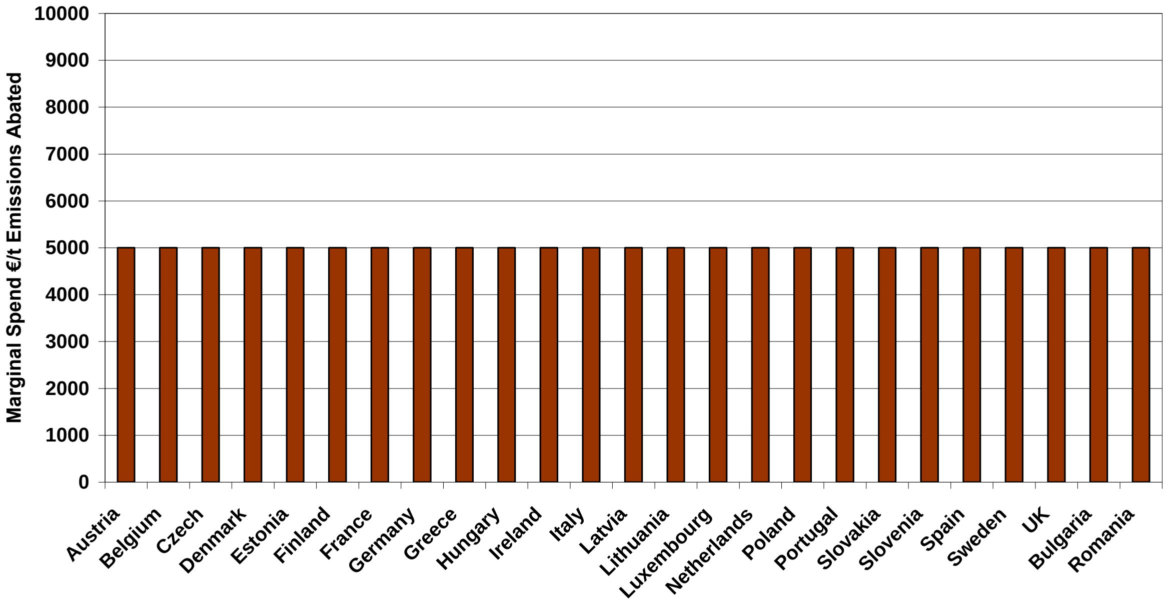
[1] Marginal abatement costs (€/t) are determined by dividing the incremental cost (€/y) by the incremental reduction in emissions (t/y) in moving from one level of abatement to the next higher level of abatement

Noting that in the ‘technology driven’ case the €/kt is the same in each MS (Figure 5), dividing equation (4) by equation (5) yields:

$$[\text{€}/\mathrm{YOLL}_{\mathrm{MS1}}]/\ [\text{€}/\mathrm{YOLL}_{\mathrm{MS2}}] = [\mathrm{YOLL}/\mathrm{kt}_{\mathrm{MS2}}]/\ [\mathrm{YOLL}/\mathrm{kt}_{\mathrm{MS1}}] \qquad (6)$$

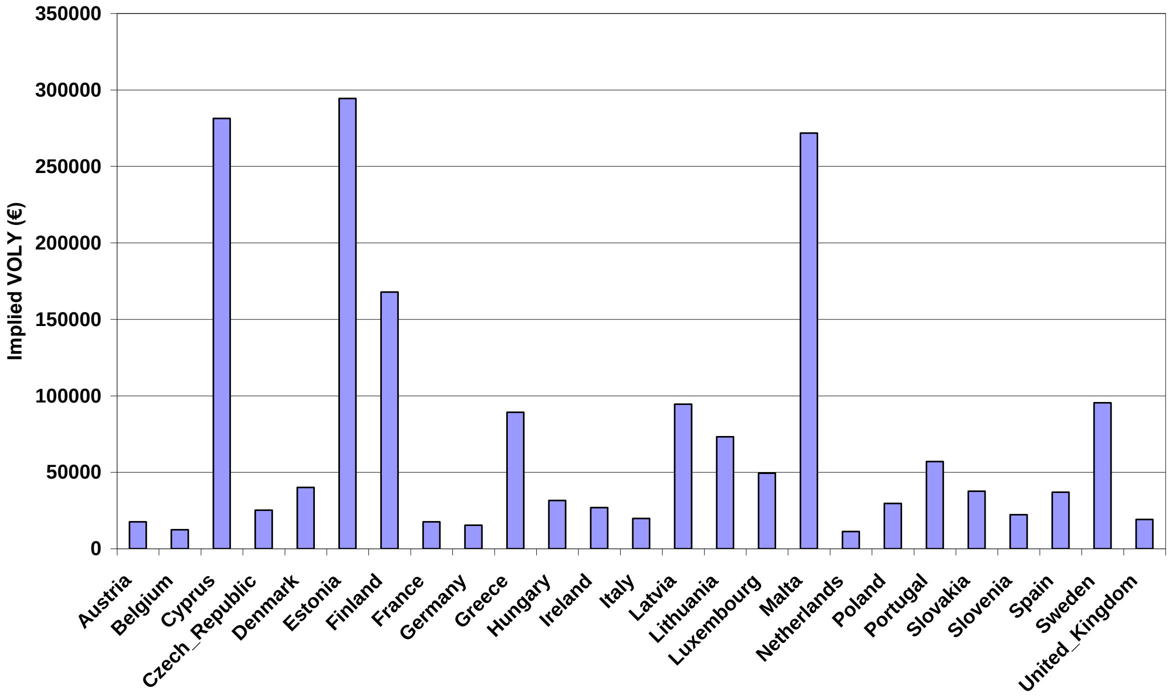
## FIGURE 5: A TECHNOLOGY ‘LEVEL PLAYING FIELD’ (ASSUMING EQUAL MARGINAL SPEND PER UNIT OF EMISSION ABATED)



Equation 6 clearly serves to demonstrate the problem of disproportionality that results from the technology driven approach in a context where emission potencies (here YOLL/kt) vary significantly across MS. Taking the same three countries explored previously under the effects driven discussion: The valuation of a life year (VOLY) in Spain to support the notion that marginal abatement costs should be the same in both countries, would be 3.33 times (1/0.3) that of the Netherlands. In the case of Finland this would increase to more than 14 times (1/0.07) that of the Netherlands.

These very large differences in the attributed values of life years for the EU citizens between MS resulting from this approach are in direct contradiction to the principle of proportionality enshrined in the EU treaty itself. The more complete picture of how distorting this approach is across the EU Member States is shown in Figure 6 below.

## FIGURE 6: VARIATIONS IN IMPLIED VALUATION OF A LIFE YEAR FOR EU CITIZENS WITH THE TECHNOLOGY DRIVEN APPROACH ASSUMING A MARGINAL SPEND ON $SO_2$ ABATEMENT OF €5000/TONNE



### 2.1.3 THE COMPELLING CASE FOR AN EFFECTS BASED APPROACH

To illustrate the economic benefits of adopting an 'effects driven' approach rather than a 'technology driven' approach, the following series of figures have been abstracted from a study undertaken by CONCAWE[2] at the conclusion of the Clean Air For Europe Programme. In this study[3], as in the examples already explored, the focus was on reducing the health impacts of long term exposure to fine particulates. The improvement targets are expressed as the percent of the maximum achievable reduction in impacts between the 'Baseline' (current legislation or CLE) and the application of Maximum Technically Feasible Reductions (MTFR). This is termed the 'PM2.5 Impacts Gap Closure' i.e. at CLE the Gap Closure is 0% and at MTFR the Gap Closure is 100%

Both the 'optimised effects driven' and 'technology driven' approaches were explored in the study using CONCAWE's in house integrated assessment model which incorporates the same source-receptor functions, impact algorithms and data bases as the GAINS model. Figure 7 below shows the resulting cost versus gap closure for EU-25[4] as a whole for both approaches.

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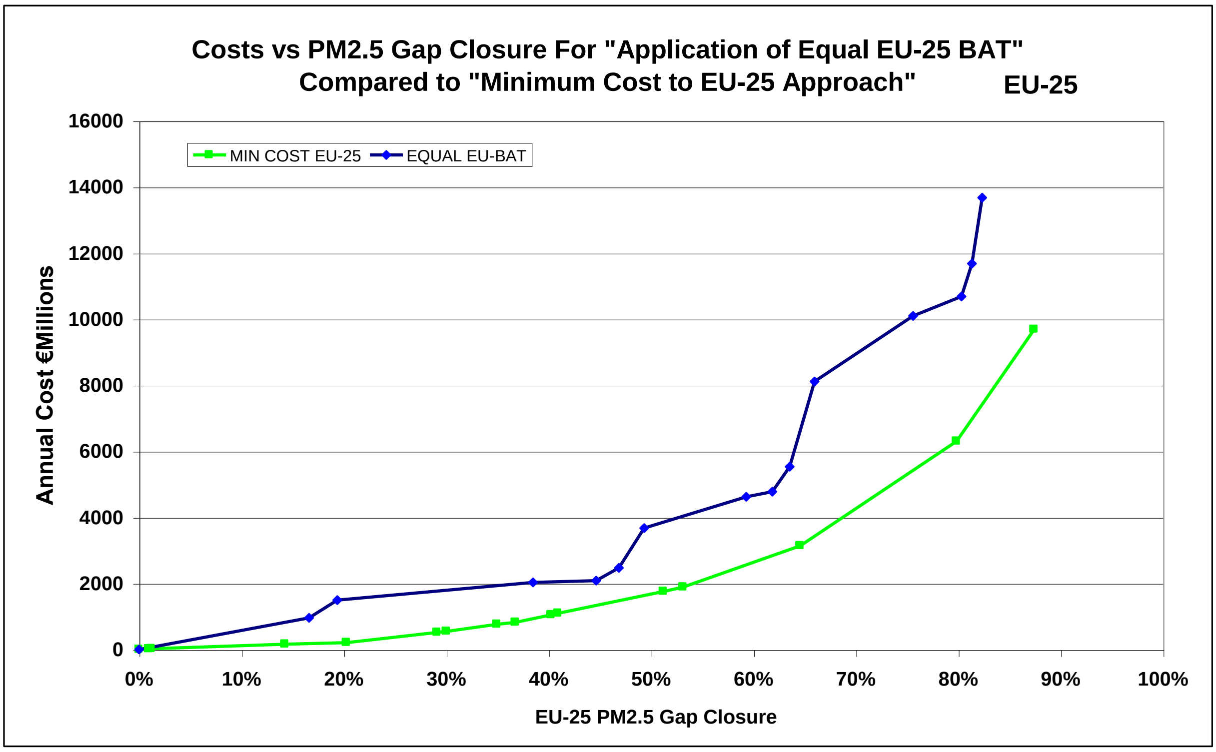
[2] CONCAWE is the European Downstream Oil Industry's technical organisation on health, safety and the environment established in 1963.

[3] "EU-wide BAT—an expensive suit that doesn't fit everybody", CONCAWE Review Article, November 2005

[4] The EU Membership at that time

FIGURE 7: THE COST IMPLICATIONS OF EFFECTS DRIVEN VERSUS TECHNOLOGY DRIVEN PM IMPACT REDUCTIONS IN EU-25



What is very evident from Figure 7 is that the effects driven approach (the 'MIN COST EU-25' curve) is much more economically efficient in delivering further reductions in PM2.5 impacts than the technology driven alternate (the 'EQUAL EU-BAT' curve). The Commission's first Thematic Strategy on Air Pollution (September 2005) was based on a 75% PM2.5 Gap Closure; at this gap closure the cost of delivering the target under a technology driven approach would have been double that of the effects driven approach used in CAFE[5]. This underlines the wisdom of the EU Commission in continuing to adopt the effects driven approach and the need to ensure the economic benefits are preserved all the way to the realisation stage of local permitting.

To further underline the compelling case for an effects driven approach, the cost implications between the two approaches for two individual Member States are given below as Figures 7a (Germany) and 7b (Finland). In the case of Germany, with a relatively high PM impact potency, the differences between the two approaches are small. However, in the case of Finland where the impact potency is very low the differences between the two approaches are extremely large.

It is worth underlining that the health/environmental benefits are exactly the same (here expressed as PM impacts gap closure) with either the 'effects driven' or 'technology driven' approach.

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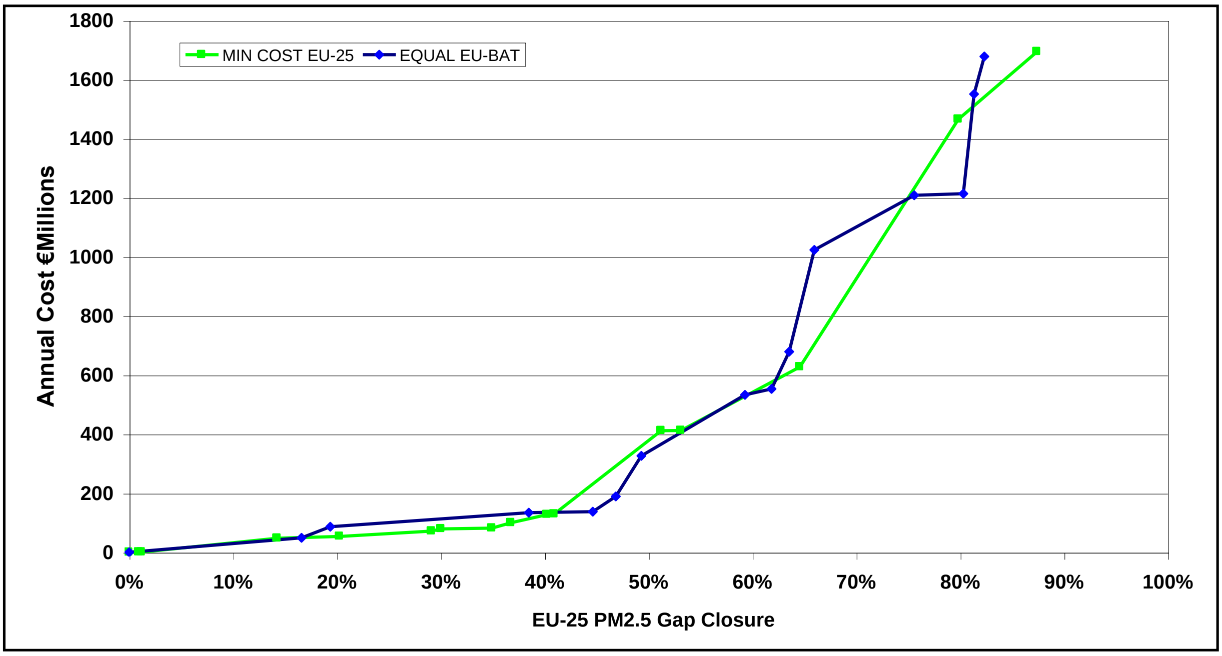
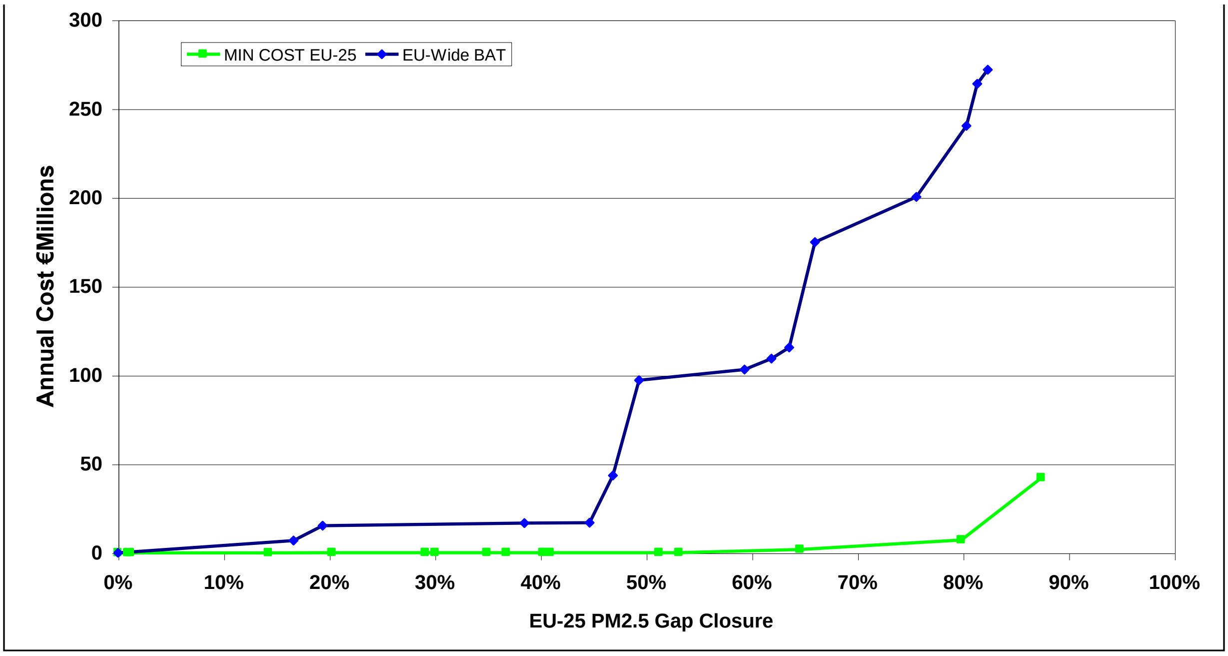
[5] EU Clean Air For Europe programme which resulted in the first Thematic Strategy on Air Pollution adopted by the Commission in September 2005

## FIGURE 7A: COST IMPLICATIONS DIFFER WIDELY BETWEEN MEMBER STATES: GERMANY



## FIGURE 7B: COST IMPLICATIONS DIFFER WIDELY BETWEEN MEMBER STATES: FINLAND

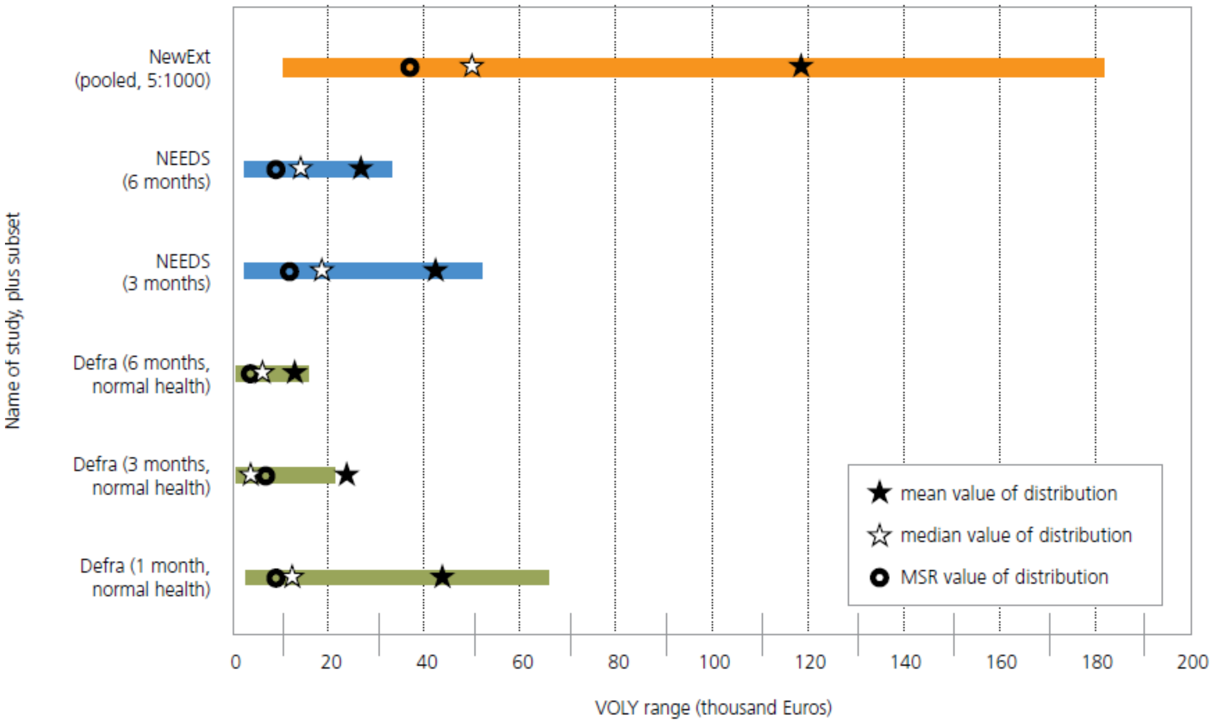


# 3. UNDERSTANDING THE DIFFERENCE BETWEEN VALUATIONS OF EXTERNAL COSTS WITH THEIR ASSOCIATED 'SHADOW PRICES' AND THE AS ADOPTED 'POLICY SHADOW PRICES'

A key step in the development of policies designed to bring about further improvements in air quality is the setting of the ambition level(s). One increasingly important input to this process is the valuation of the 'external costs'[6] with a view to expressing the benefits of achieving the ambition level(s) to compare with the cost of delivery. Although this element has increased in its importance over the past decade, it is certainly not the only important consideration in setting the final adopted ambition level(s). Proportionality in the cost involved in managing this particular risk or set of risks, is clearly another key consideration. Here though our focus is on the valuation of external costs, their associated 'shadow prices' (expressed as €/t) and how these compare to the Policy Shadow Prices (the marginal spend on abatement measures in €/t) of the final adopted ambition level(s).

## 3.1 VALUATIONS OF A STATISTICAL LIFE YEAR LOST FROM WILLINGNESS TO PAY SURVEYS VARY SIGNIFICANTLY WITHIN A GIVEN SURVEY AND ACROSS DIFFERENT SURVEYS

### FIGURE 8/TABLE 1: VARIATIONS IN VOLY WITHIN A GIVEN WILLINGNESS TO PAY SURVEY AND ACROSS DIFFERENT SURVEYS (SOURCE: CONCAWE REVIEW SPECIAL ISSUE 'YEAR OF AIR' 2014, CHAPTER 5: CBA UNDER THE MICROSCOPE, FIGURE 17 AND TABLE 6)



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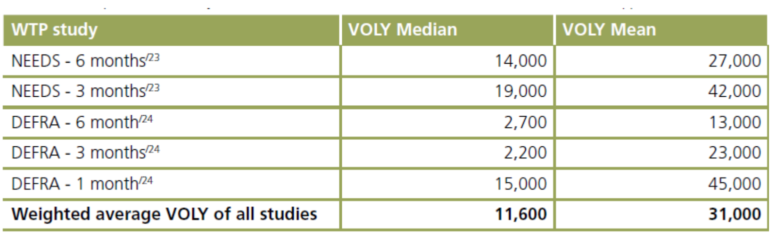
[6] In this context these 'external costs' are the damage costs attributed to the impacts of air pollution e.g. the loss in statistical life expectancy due to long term exposure to fine particulate concentrations in the air.



| WTP study | VOLY Median | VOLY Mean |
|---|---:|---:|
| NEEDS - 6 months[23] | 14,000 | 27,000 |
| NEEDS - 3 months[23] | 19,000 | 42,000 |
| DEFRA - 6 month[24] | 2,700 | 13,000 |
| DEFRA - 3 months[24] | 2,200 | 23,000 |
| DEFRA - 1 month[24] | 15,000 | 45,000 |
| **Weighted average VOLY of all studies** | **11,600** | **31,000** |

Figure 8 and Table 1 above show the range of individual responses from a number of European 'Willingness to Pay' (WPT) surveys designed to provide valuations for extending life expectancy by one year (VOLY value). The sole purpose of including these data is to illustrate the huge range of individual elicited responses within a given survey and between different surveys. The variation within each of the surveys characteristically has a highly skewed distribution (valuations typically varying by three orders of magnitude) with the median value at about half of the mean. Although somewhat outdated by more recent surveys (e.g., the NEEDS[7] survey given in the table), the recent Air Policy Review undertaken by the Commission services continued to use the median value of the NewExt[8] study used in CAFE but adjusted for inflation to yield a VOLY of €57,000. This compares to the median of the more recent NEEDS study of €14000-€19000.

To derive the shadow prices implied by a given VOLY we need to again make use of the simple relationship developed in section 2.1.1 restated here for clarity:

$$\text{Marginal Abatement Cost, €/kt}_{\text{abated}} = \text{€/YOLL*YOLL/kt}_{\text{MS1}}$$

Using the $SO_2$ emission potencies across EU MS that underpin Figure 3, the shadow prices, €/t$SO_2$, shown in Figure 9 were derived for a VOLY of €57,000. For comparison purposes, a second case of €19,000 is also shown (the NEEDS median value from their 3-month WTP survey).

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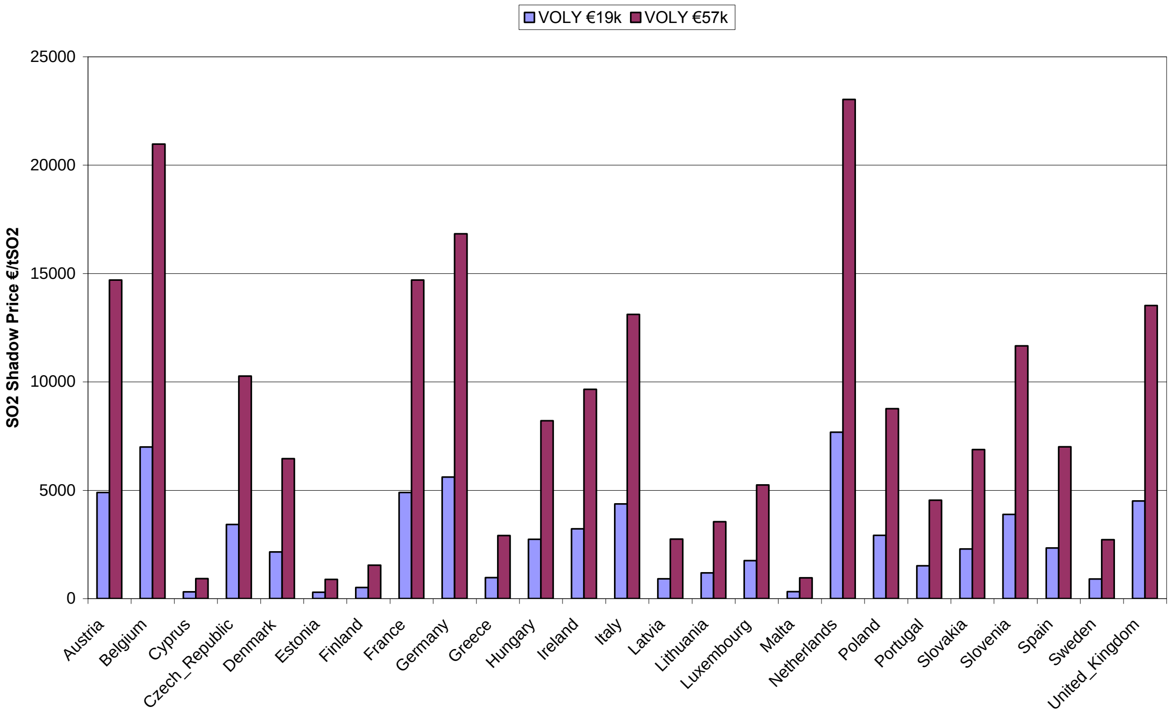
[7] Desaigues, B., Ami, D., Bartczak, B., Braun-Kohlová, M., Chilton, S., Czajkowski, M., Farreras, V., Hunt, A., Hutchison, M., Jeanrenaud, C., Kaderjak, P., Máca, V., Markiewicz, O., Markowska, A., Metcalf, H., Navrud, S., Nielsen, J.S., Ortiz, R., Pellegrini, S., Rabl, A., Riera, R., Scasny, M., Stoeckel, M.-E., Szántó, R. and Urban, J. Economic valuation of air pollution mortality: A 9-country contingent valuation survey of value of a life year (VOLY). Ecological Indicators, 11 (3): 902–910. 2011.

[8] NewExt - Final Report to the European Commission, DG Research, Technological Development and Demonstration (RTD). IER (Germany), ARMINES / ENSMP (France), PSI (Switzerland), Université de Paris I (France), University of Bath (United Kingdom), VITO (Belgium). September 2004.

## FIGURE 9: VARIATION IN $SO_2$ SHADOW PRICE ACROSS INDIVIDUAL MEMBER STATES OF EU-25 FOR TWO DIFFERENT VALUATIONS OF A LIFE YEAR (VOLY)



As discussed earlier, the significant variation in impact potencies across the EU Member States results in a correspondingly large variation in shadow price. These same large variations between Member States are apparent in the 'shadow prices' shown in Annex 12 of the Economic and Cross Media Effects BAT Reference Document [9].

Before moving on to comparing these shadow prices with the Policy Shadow Prices reflected in the Air Policy Package proposed by the Commission in December 2013 and currently under consideration by the EU Institutions, it is worth reflecting on the implications of Figure 9. In principle these are expressions of the health benefits (here the statistical improvement in life expectancy for EU-citizens from reduced exposure to fine particulates) associated with a reduction of one tonne of $SO_2$ emissions. The notion here is that if monetised benefits were the sole determinant of policy, these benefits would support the same level of expenditure on marginal abatement costs. However, even for high cost technologies that maximise abatement, their marginal cost/tonne may be significantly exceeded at very high shadow prices. This can have a very distorting effect on the equitable burden sharing that should underpin the effects driven approach.

This can be readily illustrated from Figure 9. Let's assume that the marginal abatement cost for the technology that provides maximum abatement of $SO_2$ is €12,500/tonne. In the €57,000 VOLY case this would mean seven Member States would be driven to maximum available abatement and not be able to fully realise their attributed externalities. In the case of the Netherlands and Belgium, this would effectively reduce their VOLY value from €57,000 to less than €35,000. The other 18 Member States would of course be applying measures consistent with a VOLY of €57,000.

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[9] European IPPC Bureau, Seville, July 2006

The level of distortion (or disproportionality) of course increases at higher valuations of VOLY. For example, using the €120, 000 VOLY (Mean of NewExt) 'sensitivity case' assumed by DG Environment during the technical phase of the recent Air Policy Review, would generate no change in the 'technology limited' cases of Belgium and the Netherlands (their VOLY would remain at less than €35,000) but in the ten MS with the lowest potencies, their abatement costs would fully reflect the 120,000 VOLY. Thus very high externalities tend toward levelling the 'technology applied' playing field but significantly depart from the principle of proportionality.

It is finally worth noting that at a VOLY of €19,000 (reflecting the NEEDS Median valuation) all countries are able to implement measures that fully reflect the external costs i.e. Highest shadow price is €7,500/tonne $SO_2$ (Netherlands).

## 3.2 UNDERSTANDING POLICY SHADOW PRICES

In the previous section we focussed on the valuation of external costs based on willingness to pay surveys. In particular we looked at the valuation of a life year (VOLY) and how this can be used to determine the Shadow Price (€/tonne of pollutant) as input to policy development designed to further reduce the impacts of exposure to fine particulates.

It is important to recognise that the valuation of external costs is only one input to policy development. Other key considerations include the need to ensure the final ambition level appropriately balances the expenditure on a given societal risk with the expenditures on other societal risks. Since we live in a multi-risk world, it is vital that individual policy responses are not disproportional (hence the inclusion of the proportionality principle in the EU Treaty itself).

In simple terms, this means it is not enough to conclude that an individual policy ambition level is appropriate if the quantified marginal benefits exceed the marginal costs. This is not only because of the high uncertainties involved in the quantification of external costs but also because of the Policy Makers' responsibility to carefully test whether the incremental spend between the proposed ambition level and a lower ambition level, if spent on mitigating other risks, would deliver greater benefits.

Another important consideration is the need to ensure that the final adopted policy ambition level is robust to a different "future world" to that/those considered during the development phase of policy.

In the context of the EU, such considerations are concluded when the College of Commissioners (the most senior level of 'Risk Managers' in the European Commission) adopt a proposal for consideration by the Council and Parliament.

The shadow prices implicit in a proposed policy e.g. the revised TSAP and associated new National Emission Ceilings Directive (NECD) are what we here refer to as the 'Policy Shadow Prices' reflecting the ambition level(s) of the proposal.

In the case of the NECD, these may be determined from the individual emission ceilings designed to deliver the ambition level(s). In the process of determining individual ceilings (by pollutant and by Member State), the IIASA GAINS model utilises detailed abatement cost data. Therefore for each Member State, for every pollutant emission ceiling, the highest marginal cost (€/tonne) is known. These marginal costs by pollutant in each Member State constitute their Policy Shadow Prices.

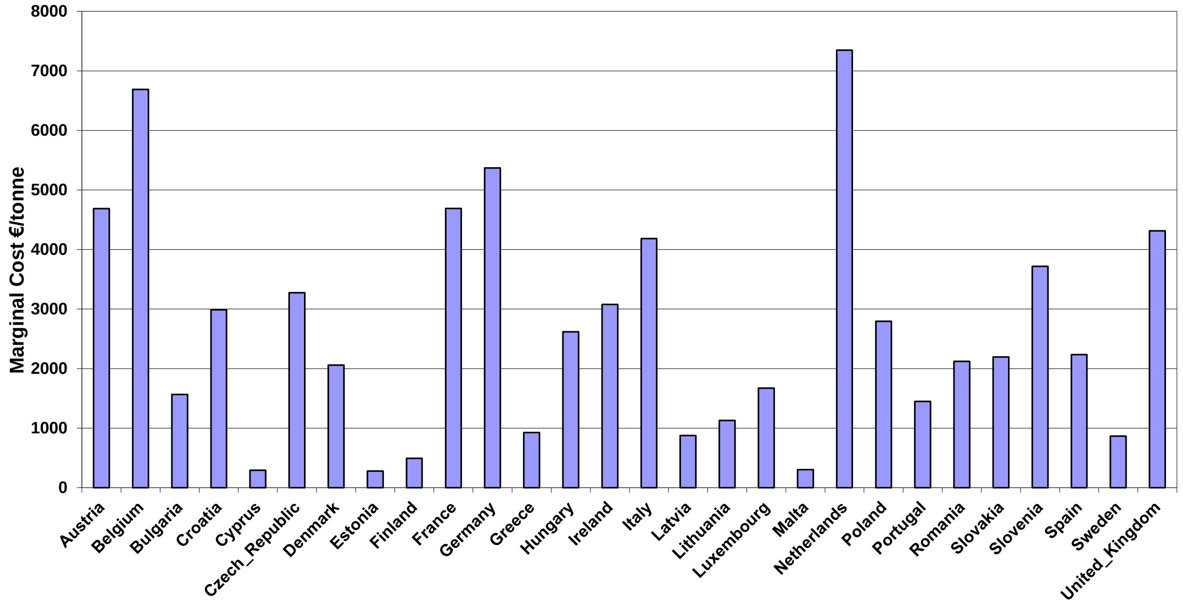
In the past IIASA have provided so-called ‘cost-curves’ for each pollutant by individual Member State i.e. additional cost versus further emission reduction. The gradient of each of these cost curves at the emission ceiling (in units of €/t) is exactly equivalent to the Policy Shadow Price.

For each individual Member State, for each pollutant, this corresponds to the highest marginal spend on additional abatement measures.

### 3.2.1 POLICY SHADOW PRICES FOR $SO_2$ UNDERPINNING THE RECENT UPDATE OF THE TSAP AND ASSOCIATED REVISION OF THE NEC DIRECTIVE

So in the case of the recently adopted Air Policy Package with its proposed NECD what are the implied Policy Shadow Prices? These are shown in Figure 10 for $SO_2$ and were derived from the detailed data downloadable from the GAINS website[10].

FIGURE 10:$SO_2$ POLICY SHADOW PRICES (€/TONNE (BASED ON GAINS WPE OPTIMISED CASE [67% GAP CLOSURE] FOR REVISED NECD)



It is noteworthy that the final adopted package by the College of Commissioners was based on achieving an optimised delivery of a 67% PM Impact Gap Closure. This was less ambitious than the ambition of the so- called central case proposed by DG Environment at the conclusion of the technical phase of the Air Policy Review[11]. Since the adopted proposal was based on optimising reduction of pollutants to achieve the PM impacts target alone (PM only driven optimisation with come along benefits for ozone impacts and reductions in acidification/Eutrophication from the resulting emission reductions) it is possible to determine the implied VOLY that would be consistent with the final proposal. This is close to the €19,000 median value of the NEEDS Willingness to Pay survey results discussed above and explains why the Policy Shadow Prices in Figure 10 are essentially the same as the ’€19k shadow prices’ of Figure 9.

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[10] Documented in IIASA TSAP Report #16a and 16b, January 2015

[11] See IIASA TSAP Report #10, March 2013: 75% Gap Closure Case

We can now move on the final step of how to connect these policy shadow prices with air permitting under the IED/BREF at a geographically specific site i.e. i-PASS[12]. Given the context, we shall focus here on Refineries but the same process can be applied at any industrial installation.

## 4. APPLYING THE POLICY SHADOW PRICES TO LOCAL PERMITTING: I-PASS

To illustrate the application of i-PASS we will focus on just one important process area within the Refinery; The Sulphur Recovery Unit (SRU). Full use has been made of CONCAWE's published reports and formal submissions to the recent revision of the EIPPC Bureau's revision of the Refinery BAT Reference Document.

The cost and cost effectiveness of applicable emission abatement techniques shown in the following figures were determined using the data and methodology from CONCAWE's report 6/11 *'Cost-effectiveness of emissions abatement options in European refineries'*[13] supplemented by the Cost-Effectiveness example cases for operating SRUs and FCCUs in EU refineries submitted to BATIS during the Refinery BREF revision process. The data on the specific requirements of the BREF, including the upper and lower BAT Associated Emission Levels (BAT AELs), are taken directly from the relevant sections of the updated Refinery BAT Reference document[14]

### 4.1 AN EXAMPLE APPLICATION OF I-PASS TO THE REFINERY SULPHUR RECOVERY UNIT

Figure 11 below shows the essential elements of i-PASS application to an existing SRU in a European Refinery. Working through the elements of this step by step:

Since the BREF (BAT 54 of the BREF Conclusions) expresses BAT AEL for an SRU as overall recovery efficiency, the vertical axis of Figure 11 is shown consistent with this performance parameter. The horizontal axis, in marginal cost/tonne[15] of emission reduction, is designed to show the relationship between performance (here SRU recovery efficiency) and the incremental cost of the available techniques able to deliver the required AEL.

The three horizontal lines, at 99%; 99.5% and 99.9% respectively, show the minimum environmental performance level for existing SRUs and the lower and upper environmental performances levels for new SRUs. These are transposed directly from Table 5.17 of the Refinery BREF.

The red diamond at zero €/t and 96.5% SRU recovery efficiency shows the 'current performance'[16] of this particular existing SRU.

The lowest over-plotted horizontal bar, shows the cost-effectiveness range for retrofitting technology on this specific unit to meet the minimum environmental performance level (98.5%) required by the BREF for existing installations. The reason for the range (here small) in €/tonne, as in all the other cases, reflects the range in costs given for the underlying technique in the CONCAWE cost-effectiveness report.

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[12] i-PASS is a proprietary methodology developed by Aeris Europe Limited

[13] Published in 2011

[14] Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas, EIPPC Bureau, Seville,

[15] Marginal Cost/tonne is the incremental cost divided by the reduction in tonnes of emissions in moving from one level of abatement to the next level of abatement e.g. from Base Case to the next available technique offering a higher recovery efficiency.

[16] Given the timing of the BREF review this is based on 2010 performance data

The middle over-plotted horizontal bar, shows the incremental cost-effectiveness range for retrofitting technology on this specific unit to move it from meeting the minimum environmental performance level (98.5%) required by the BREF for existing installations to meeting a 99.5% environmental performance level.

The upper over-plotted horizontal bar, shows the incremental cost-effectiveness range for retrofitting technology on this specific unit to move it from meeting an environmental performance level of 99.5% to the highest available environmental performance level of 99.9%.

The key final step is to over-plot the Policy Shadow Price to determine where in the BATAEL range the site specific performance should fall to be consistent with the TSAP/NECD. Three country shadow prices for $SO_2$ are shown on Figure 11: Those of Finland, Poland and the Netherlands.

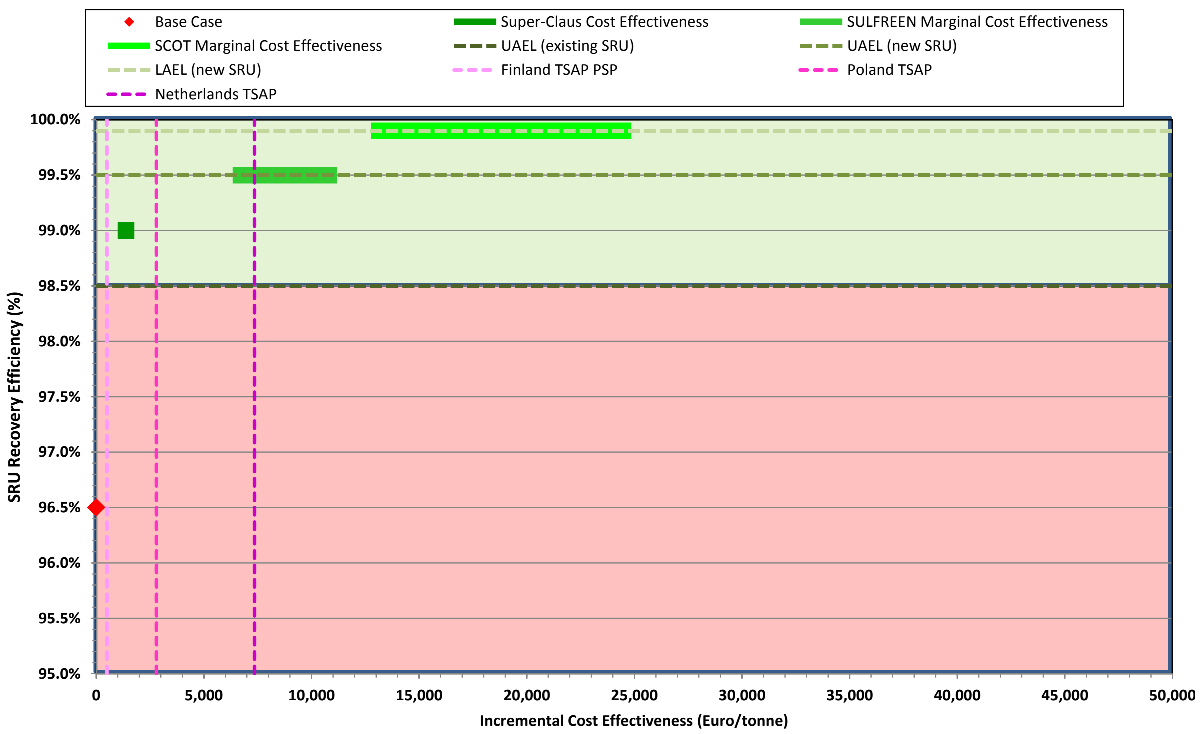
If this specific SRU was operating in Finland, although the $SO_2$ Policy Shadow Price for Finland would not support the cost of retrofitting the existing unit to a 'Super-Claus' performance of 99% recovery, the BAT conclusions require a minimum performance of 98.5% so upgrading this unit from its Base Case performance of 96.5% recovery efficiency to achieve 98.5% would be required.

If the unit was operating in Poland, then the $SO_2$ Policy Shadow Price for Poland would support the retrofitting of the existing unit to a Super-Claus performance level (99%) but not to the 'SULFREEN' (99.5%).

If this specific unit were operating in the Netherlands, then the $SO_2$ Policy Shadow Price for the Netherlands would support the retrofitting of the existing unit to a SULFREEN performance level (99.5%) but not to the 'SCOT' (99.9%).

In each of these three MS this approach to the determination of the AEL within the BREF range would ensure complete alignment of the permitting process with the overarching legislative instruments designed to provide proportional and cost-effective delivery of the Thematic Strategy on Air Pollution e.g. NEC Directive.

## FIGURE 11: THE EXAMPLE OF THE APPLICATION OF I-PASS TO A REFINERY SRU



## 5. SOME CONCLUDING REMARKS

While respecting the requirements of 'General Binding Rules' (e.g. Permits must ensure AELs are within the range given in the applicable BAT conclusion of Chapter 5 of the Refinery BAT Reference Document), in certain situations, may over-ride the cost-effectiveness principle underpinning the TSAP/NECD[17]; we have seen that it is possible to fully align the local permitting process under the IED/BREF conclusions with these overarching EU legislative instruments.

This preserves the goal of these instruments to achieve their environmental targets in the most economically efficient manner. Through i-PASS this is achieved by consistently applying the tools, algorithms and data bases used at EU level to support the local air permitting process.

In so doing, the Principle of Proportionality enshrined in the EU Treaty itself and the related cost-effectiveness principle used in the design of the TSAP/NECD are clearly preserved.

In the context of our ever pressured EU or individual Member State economies, this has to be good news for all Stakeholders.

Finally, the promotion of high valuations of external costs (based on willingness to pay social surveys) as a basis for local permitting which go far beyond the 'risk management' decision implicit in the overarching EU legislation inevitably results in highly disproportional spends. In many cases, (Finland is one) these are in countries with more pristine environments in the base case.

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[17] Unless there is a successful granting of a derogation