



Project no: 502687

NEEDS

New Energy Externalities Developments for Sustainability

INTEGRATED PROJECT

*Priority 6.1: Sustainable Energy Systems and, more specifically,
Sub-priority 6.1.3.2.5: Socio-economic tools and concepts for energy strategy.*

Deliverable n° 12.2 - RS 2b

Reporting and evaluation of the survey on the "externality concept"

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Authors: Stefano Faberi, ISIS – Silvia Gaggi, ISIS. With contributions from: Stefan Hirschberg – PSI

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|---|---|----|
| Dissemination Level | | |
| PU | Public | PU |
| PP | Restricted to other programme participants (including the Commission Services) | |
| RE | Restricted to a group specified by the consortium (including the Commission Services) | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

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1 The Aim of the Questionnaire

The NEEDS questionnaire "Acceptance of the Externality Concept" has been designed to assess stakeholders' acceptability of the externality principles and their use in energy policy making.

The External costs estimates generated using the 'impact pathway approach' are highly attractive as they represent directly comparable aggregated measures of environmental system performance and therefore provide policy makers with a transparent scientific basis for energy and environment-related policy formulation.

Nevertheless, although research in energy externalities has been under way for many years, the use of total costs as an aggregate measure of sustainability performance is not universally recognised and their acceptance may vary between stakeholders and countries.

Internalisation policies are sometimes understood by the potential users as a means to levy additional taxes, and the benefits of such policies for society as a whole (improved sustainability, equity and market efficiency) are not widely understood and acknowledged. Moreover, the very notion of assigning a monetary value to specific social impacts, such as the risk of illness or the reduction of average life expectancy, generates some resistance.

In this respect, acceptability may represent a major barrier towards the increased use of internalisation policies, restraining policy makers from taking measures based on the monetary valuation methods.

2 The Structure of the Questionnaire

The questionnaire has been prepared in an electronic version so as to be easily filled online. Stakeholders had the possibility to view and fill the questionnaire in four languages: English, French, German and Italian.

It has been structured in four main sections:

- **The Concept of Externalities**
 - 3 questions on the main principles
 - 8 questions on the suitability of monetization for different impacts and activities
- **The Bottom-Up Approach** to Estimating External Costs (Strong and Weak Points)
- **The Use of Results**
- **The Assessment and Implications**
 - 4 questions on the relative technology impacts
 - 3 questions on the implications of the assessment

3 General Statistics

The questionnaire has been sent to a total of **2205 addresses** in two rounds.

The first round has been launched during the month of January and February 2007. This run provided relevant results (presented during the Policy Meeting of Ljubljana in March 2007) but with a relatively low rate of answering. To increase the answering audience it was decided to make a second run, also because, in the meantime, the contact database was considerably increased. This second round took place during the months of May and June 2007.

Taking into account the answers and some comments provided by the respondents during the first round, in the second round the questionnaire has been shortened and simplified. The email list included 566 German contacts, 382 Italian, 525 Swiss, 101 French, 72 Belgian, 52 from the UK. 49 Countries were represented in the database, including EU and non EU Member States.

A total of **248 responses (11%)** were received. More or less 170 people have answered to the entire questionnaire.

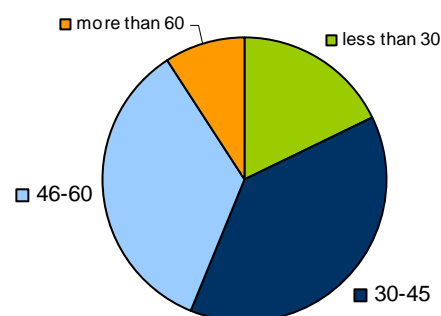
In addition, as for the second round the questionnaire contained less queries compared to the first one, it has to be considered that for certain questions there is a difference in the total respondents (200 for the complete version of the questionnaire and 248 for the shortened one).

As the first set of questions asked about the 'profile' of the respondents, it is possible to present a statistical overview of the stakeholders that participated to the survey, in terms of age, gender, education and working category.

The 'typical respondent' is therefore middle aged, male, with (very) high education and working in the research or energy supply fields.

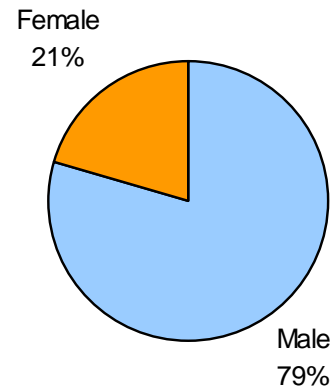
Age:

| | Response Total | % |
|--------------|----------------|------|
| 30-45 | 95 | 38% |
| 46-60 | 86 | 35% |
| less than 30 | 44 | 18% |
| more than 60 | 23 | 9% |
| Total | 248 | 100% |



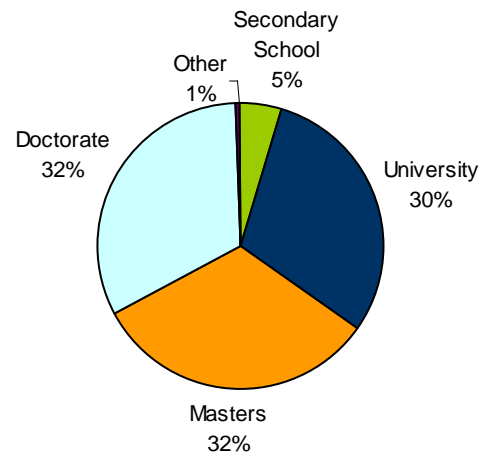
Gender:

| | Response Total | % |
|--------|----------------|------|
| Male | 197 | 79% |
| Female | 51 | 21% |
| Total | 248 | 100% |



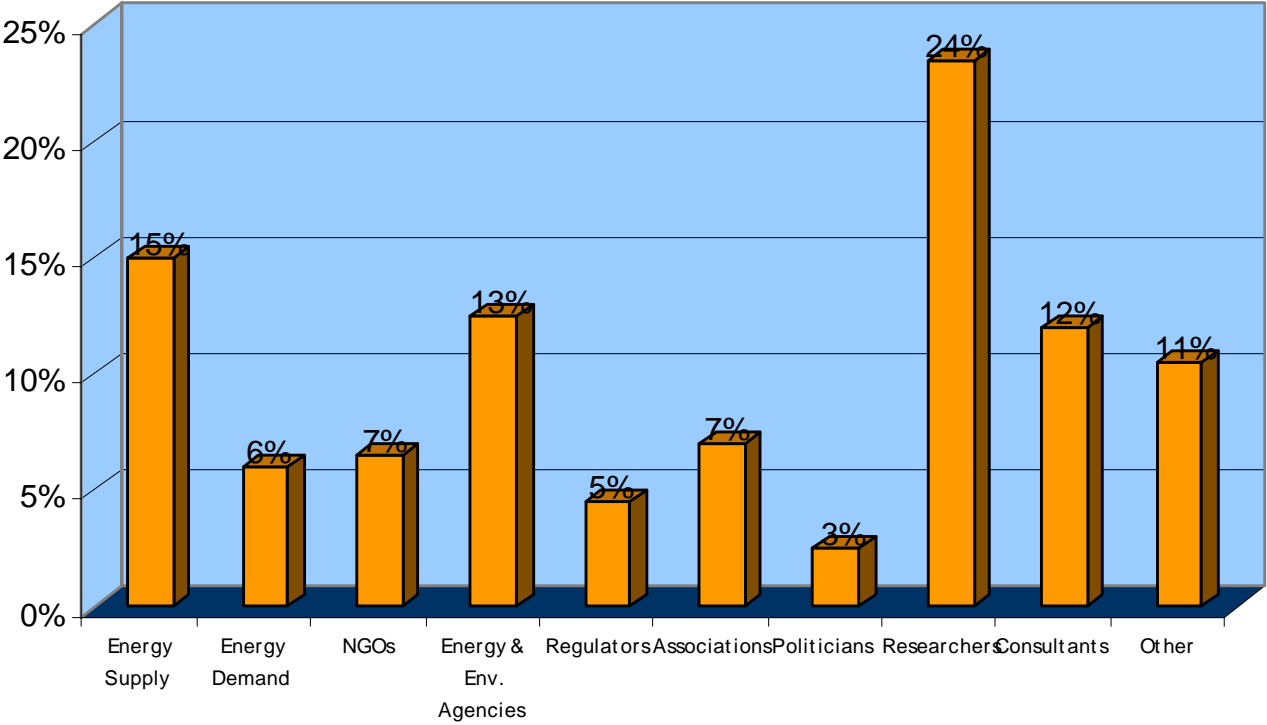
Level of formal education:

| | Response Total | % |
|---------------------------|----------------|------|
| Secondary School | 9 | 5% |
| University | 57 | 30% |
| Masters | 61 | 32% |
| Doctorate | 62 | 33% |
| Other | 1 | 1% |
| Total | 190 | 100% |
| <i>(skipped question)</i> | 58 | |



Stakeholder categories:

| | Response Total | % |
|--|----------------|------|
| Researchers | 47 | 24% |
| Energy Supply | 30 | 15% |
| Governmental Energy & Environmental Agencies | 25 | 13% |
| Consultants | 24 | 12% |
| Other, please specify | 21 | 11% |
| NGOs | 13 | 7% |
| Associations | 14 | 7% |
| Energy Demand | 12 | 6% |
| Regulators / Authorities | 9 | 5% |
| Politicians | 5 | 3% |
| Total Respondents | 200 | 100% |



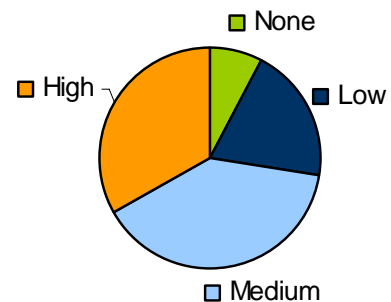
4 The results

4.1 SECTION 1 - The Concept of Externalities

In this section stakeholders were asked at first about their familiarity with the Concept of externalities. Due to the high level of education highlighted above, the percentage of respondents with medium or high knowledge resulted to be very significant (76%).

Familiarity with the Concept of Externalities:

| | Response Total | % |
|--------|----------------|------|
| Medium | 98 | 40% |
| High | 82 | 33% |
| Low | 49 | 20% |
| None | 19 | 8% |
| Total | 248 | 100% |



The questionnaire then presented a first set of questions on the main principles laying behind the externality concept, such as the 'polluter pays principle', the 'monetization of the environmental damages and the need for governmental intervention to internalize the external effects.

The possible answers provided were: fully disagree, mostly disagree, mostly agree, fully agree and 'I don't know'. It was also given the possibility to provide comments.

The responses received were mostly in favour of the three principles (between 80 and 90%).

| The "Polluter Pays Principle" | | |
|---|----------------|------------|
| <p>The principle that those causing pollution should pay the damage costs their emissions cause is generally accepted and has been applied to industries that produce harmful wastes. Do you agree or disagree that this principle should be also applied to other types of damage costs like those arising from climate change, air pollution, noise and landscape impacts, etc?</p> | | |
| | Response Total | % |
| Fully agree | 114 | 55% |
| Mostly agree | 72 | 35% |

| | | |
|--------------------------------|-----|------|
| Fully Disagree | 7 | 3% |
| Mostly disagree | 6 | 3% |
| I don't know | 0 | 0% |
| Total Respondents | 207 | 100% |
| Comments | 8 | 4% |
| <i>(skipped this question)</i> | 41 | |

| Monetisation | | |
|---|----------------|------------|
| Do you agree or disagree with the idea that damages to the environment and human health caused by energy supply and/or use should also be expressed in monetary terms, e.g. EURO's? | | |
| | Response Total | % |
| Fully agree | 91 | 44% |
| Mostly agree | 82 | 40% |
| Mostly disagree | 12 | 6% |
| Fully Disagree | 7 | 3% |
| I don't know | 3 | 1% |
| Comments | 11 | 5% |
| Total Respondents | 206 | 100% |
| <i>(skipped this question)</i> | 38 | |

| Government intervention | | |
|---|----------------|------------------|
| Do you agree or disagree that externalities cannot be adequately internalized by voluntary industrial action and that government intervention is therefore necessary to internalize external effects? | | |
| | Response Total | Response Percent |
| Fully agree | 109 | 53% |
| Mostly agree | 73 | 35% |
| Mostly disagree | 13 | 6% |
| Fully Disagree | 2 | 1% |
| I don't know | 3 | 1% |
| Comments | 6 | 3% |
| Total Respondents | 206 | 100% |
| <i>(skipped this question)</i> | 42 | |

The second set of questions analyzed in detail the stakeholders' opinion on the suitability of monetization for a list of impacts and activities. The impacts being:

- Loss of human lives
- Loss of biodiversity
- Damage to ecosystem
- Global warming

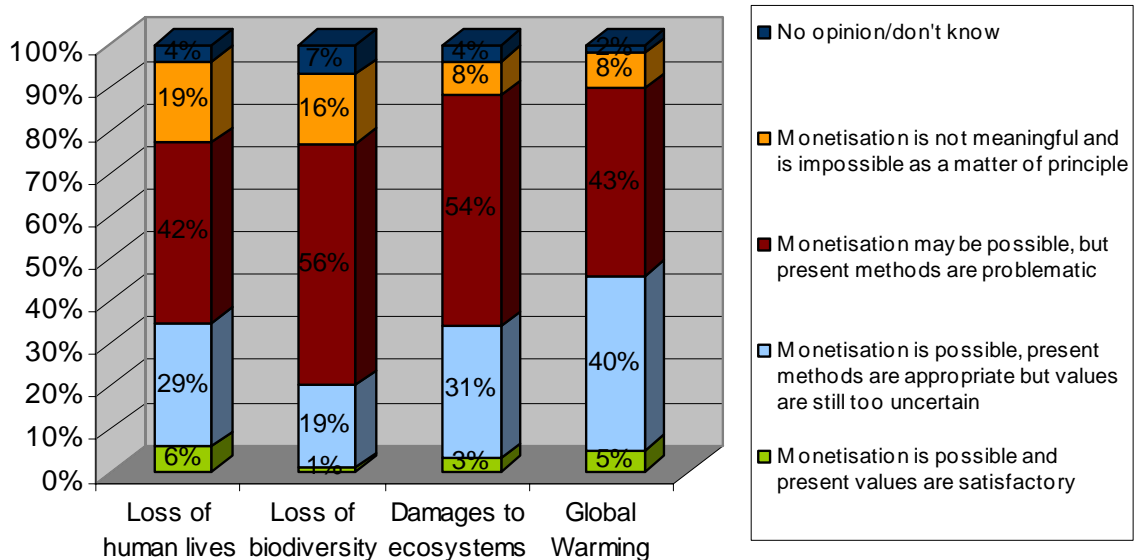
And the activities:

- Nuclear proliferation
- Security against terrorism
- Nuclear waste storage
- Security of supply of electricity

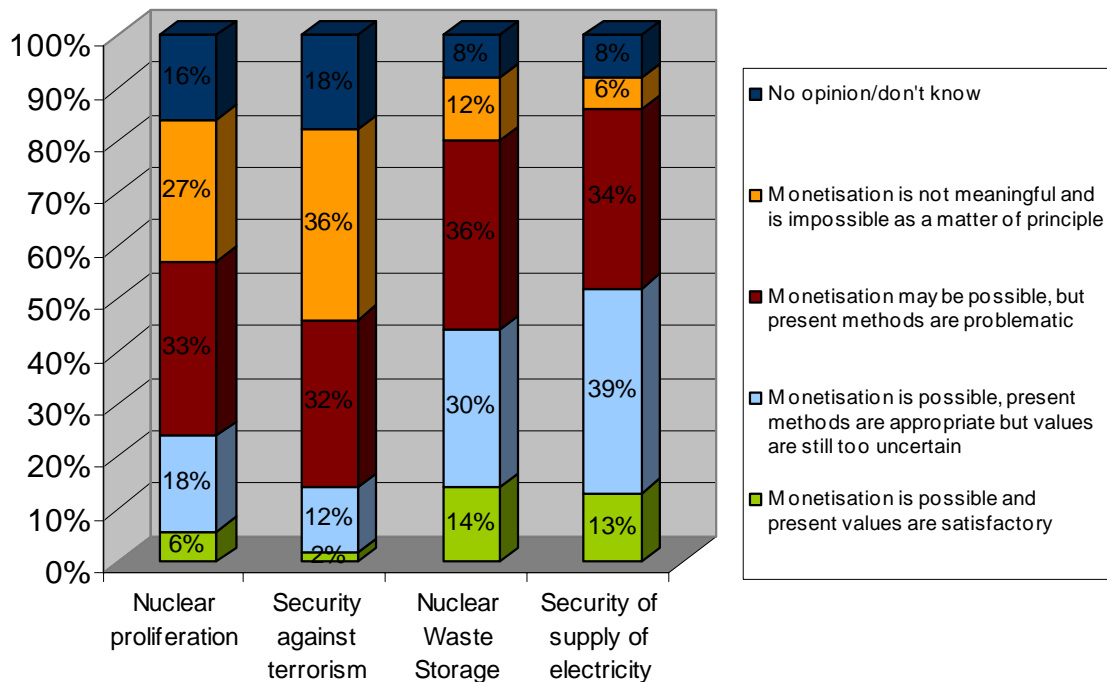
The respondents were asked to provide their opinion on the suitability of monetisation according to the following possible answers:

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic
- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

The results for the 'impacts' are the following:



While the results for the 'activities' are the following:

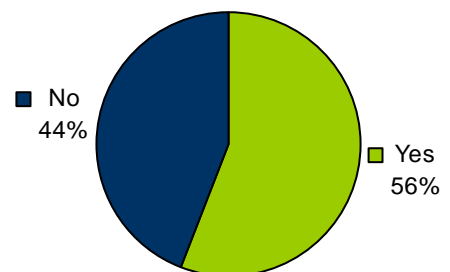


4.2 SECTION 2 - The Bottom-up approach to estimating external costs (strong and weak points)

Stakeholders were first asked about their knowledge of the Impact Pathway approach (IPA). 87 out of 200 respondents skipped the question and more than half (56%) of the remaining 113 answered that they knew about the approach.

Knowledge about IPA

| | Response Total | % |
|--------------------|----------------|------|
| Yes | 63 | 56% |
| No | 50 | 44% |
| Total | 113 | 100% |
| (skipped question) | 87 | |

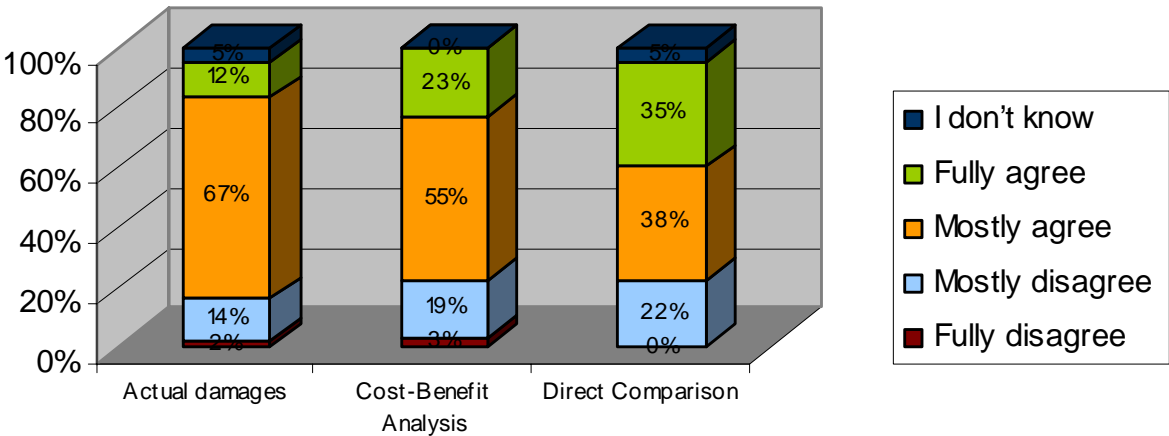


The questionnaire then asked about the stakeholders' opinion on the strengths and limitations of the Impact Pathway approach used in ExterneE, as compared to the top-down methodologies often used to account for socio-environmental damages.

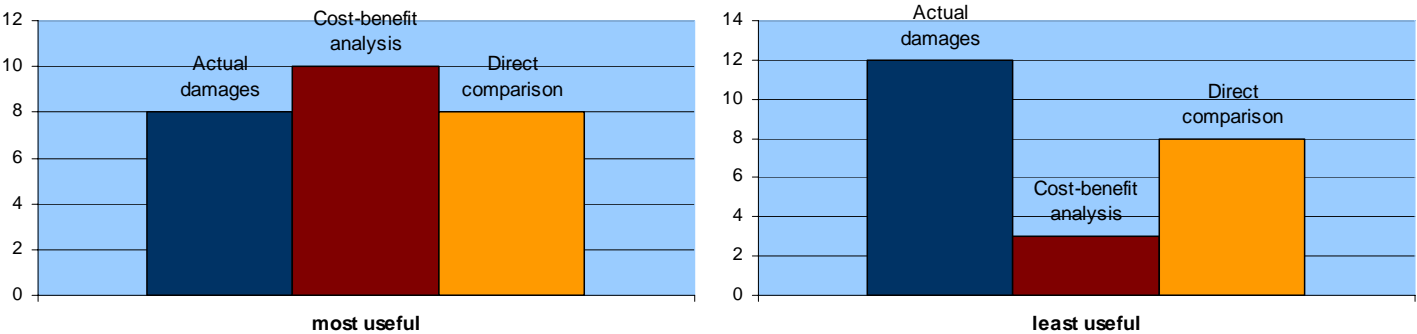
A list of statements was provided for the strengths and respondents had the choice to answer according to the following criteria: 'fully agree', 'mostly agree', 'mostly disagree' or 'fully disagree'.

Three statements were given for the strong points of the IPA:

- ACTUAL DAMAGES: The Impacts Pathway Approach is able to account for the actual damage of pollutant releases
- COST BENEFIT ANALYSIS: The results of the Impacts Pathway Approach (i.e. the monetised impacts) can be directly used in cost-benefit analysis
- DIRECT COMPARISON: The Impacts Pathway Approach for estimating external costs uses a common metric (money), which allows the direct comparison of different types of damages, providing guidance on the relative necessity and priorities for mitigation



Stakeholders were then asked to score the relative strength of the abilities of the Impacts Pathway Approach listed above, from the most useful (score = 1) to the least useful (score = 3). The results are the following:

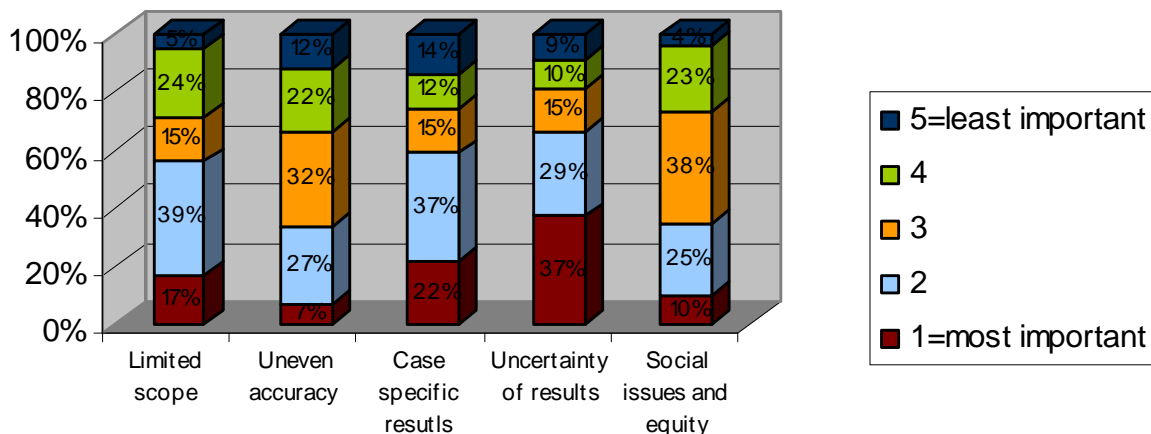


As for the limitations affecting the use of the external costs accounting framework for policy purposes, a list of five statements was provided. Respondents had to score the limitations in accordance with their knowledge and

experience, from the most important (score = 1) to the least important (score = 5).

The five statements for the limitations of the Impact Pathway approach (IPA) were the following:

- **LIMITED SCOPE:** The externalities accounting framework is essentially limited to environmental externalities and normally does not cover impacts like the depletion of fossil fuels or the threat of terrorism.
- **UNEVEN ACCURACY:** Not all the environmental externalities are dealt with at the same level of accuracy. Emissions relating to soil and water and the corresponding effects on ecosystem still need to be better analysed and accounted for.
- **CASE SPECIFIC RESULTS:** Careful thought needs to be given before generalising the results of externalities work, given that the results of each case study are context-specific.
- **UNCERTANTIES OF RESULTS:** Despite research efforts aimed at improving estimates, the uncertainty range of monetisation results can still be large
- **SOCIAL ISSUES AND EQUITY:** Issues affecting social acceptance or social equity are usually not considered, or only to a very limited extent.



4.3 SECTION 3 - The Use of results

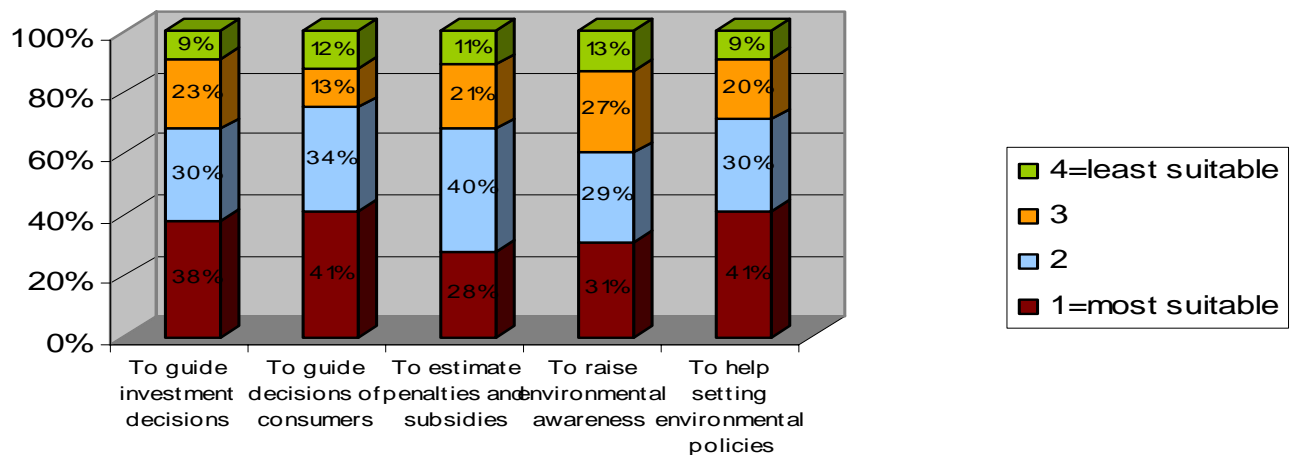
As the Impact Pathway Approach has been applied in a large number of European and national studies to give advice to the formulation of environmental, energy and transport policies, in Section 3 stakeholders were asked about possible policy uses of the external cost framework. A list of policies was provided together with an explanation of the role external costs could play:

- **To guide investment decisions:** If major electricity sources remain in public or quasi-public ownership, then the full social marginal cost of

electricity by different sources could be used to plan future capacity, with preference being given to the source with the lowest social marginal cost. Where electricity is privately owned, then full social marginal cost can be used by regulators to guide new investment or to act as an effective environmental tax, leaving the private owners to respond accordingly.

- **To guide decisions of consumers:** If the prices consumers have to pay would include external costs, they would take account of the external costs in their decisions.
- **To estimate penalties and subsidies:** To internalize external costs it is necessary to estimate environmental charges and the corresponding taxation schemes or to estimate the amount of subsidies given to environmentally friendly technologies.
- **To raise environmental awareness:** This can be done simply by drawing attention to the fact that all energy sources have externalities which give rise to economically inefficient allocations of resources.
- **To help setting environmental policies:** The basic principle would be that, as a first approximation, attention should be paid to those activities generating the highest externalities.

Respondents had to score each policy option giving a value to the suitability of the use of the external cost framework, from the most suitable (score=1) to the least (score=4).



An open question was then presented asking for other possible policy uses of the IPA approach. A wide range of answers were provided, just to give few but significant examples:

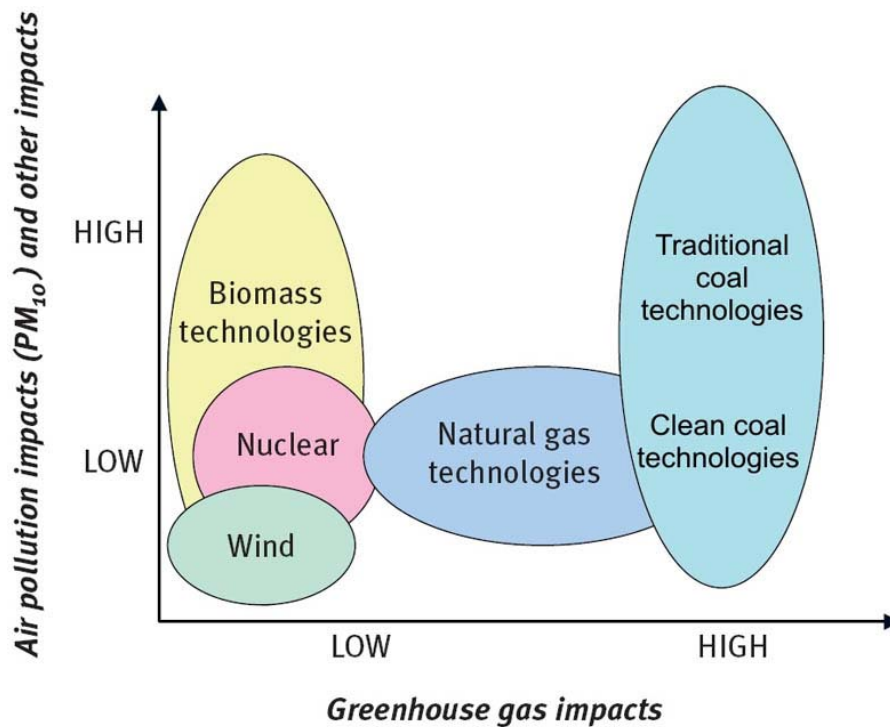
- *To construct compliance league tables of states and companies (benchmarking).*
- *For the ex ante evaluation of plans and programme.*
- *To discriminate between low impacts concerning a great number of people and large impacts focalizing on few people (large impacts should be addressed first).*
- *Impact on quality of life.*

- *Healthcare policy - to subsidise the healthcare costs of population in polluted areas.*
- *For planning policies.*
- *To guide decision of law-makers and regulators so that the polluter pays principle is enforced adequately.*
- *To determine areas where additional research is needed to lower environmental impacts and external costs.*
- *In evaluating policies that do not have an environmental objective (or that may do) - using cost benefit analysis or similar to assess the policy options.*
- *For the marginal cost of mitigation*
- *For the natural resource damage assessments, according to the Environmental Liability Act.*
- *To help land-use planners.*
- *To rise tax on energy according to externalities and to reduce tax on labor.*

4.4 SECTION 4 – The Assessment and Implication

Section 4 was divided in two parts. The first part was dedicated to the relative technological results from Externe, which after more than a decade of research has resulted in detailed sets of data for impacts from a wide range of fuels, technologies and locations. The analysis of such data illustrates how the external costs of electricity generation can largely differ depending on the choice of fuel, the technology used and the specific site.

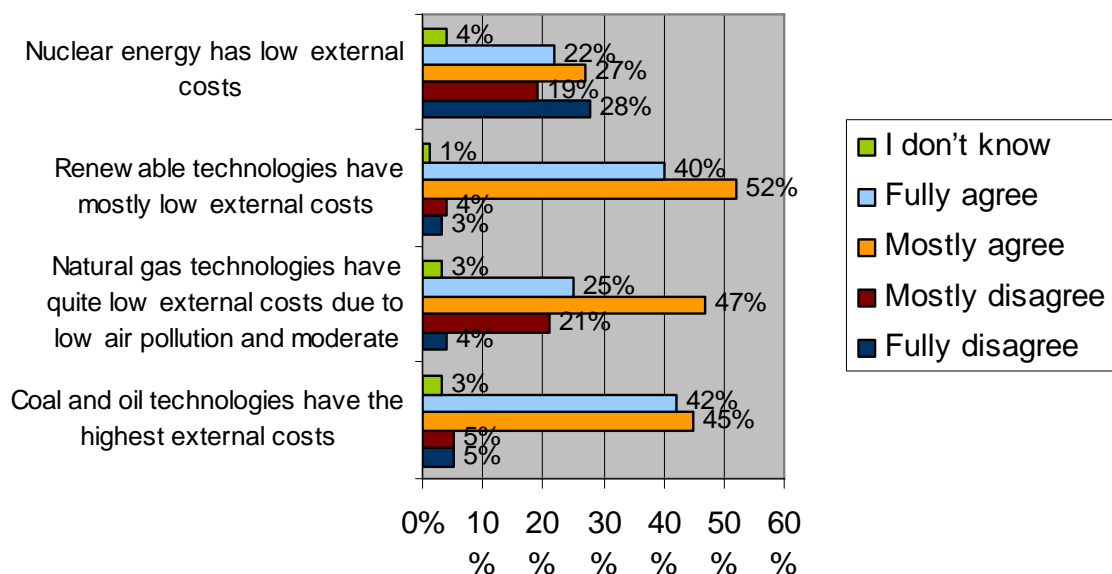
The overall results of Externe can be described in the picture, although the ExternE methodology is aiming at site and technology-specific results more than generalised ones.



Stakeholders were confronted with the diagram above and asked whether they agreed or not with a list of statements. The possible answers were: 'fully disagree', 'mostly disagree', 'mostly agree', 'fully agree' and 'I don't know'.

The statements were the following:

- Coal and oil technologies have the highest external costs
- Natural gas technologies have quite low external costs due to low air pollution and moderate external costs due to greenhouse gases.
- Renewable technologies have mostly low external costs (with the exception of some biomass technologies)
- Nuclear energy has low external costs



The second part of Section 4 dealt with the implications of the assessment. The questionnaire presented a list of some practical implications of the current ExternE evaluation system. Stakeholders were asked to indicate their agreement or disagreement.

| Site specificity v. country level application | | |
|---|----------------|------|
| <p>One of the most frequent criticisms of the externalities accounting method is that: "The results of the externalities calculation are very often for specific installations and not appropriate for policy choices that require results applicable at a wider level (i.e. at the country level)". However, since 2004 research on externalities also provides this type of results for specific countries, making the estimates more suitable for general policy decisions concerning countries. Do you think this is the right way to go?</p> | | |
| | Response Total | % |
| Yes | 87 | 69% |
| No | 12 | 9% |
| I don't know | 28 | 22% |
| Total Respondents | 127 | 100% |

| Cost of omitting externalities in decision-making | | |
|--|----------------|------|
| <p>Despite the presence of uncertainties, external cost assessment provides decision makers with basic estimates to support their policy decisions. Without such estimates the social cost of a wrong choice could be very large and harmful</p> | | |
| | Response Total | % |
| Fully disagree | 10 | 6% |
| Mostly disagree | 5 | 3% |
| Mostly agree | 84 | 50% |
| Fully agree | 63 | 38% |
| I don't know | 3 | 3% |
| Total Respondents | 168 | 100% |

Use of expert consensus v. uncertainty ranges

One way to be able to use the external costs method, in spite of uncertainties and large spread of results is to seek consensus on some “recommended” figures to be provided to policy makers or stakeholders instead of letting them choose among wide ranges. For example the range of costs for climate change damages from CO₂ and other greenhouse gases are very wide, but nevertheless recent studies (i.e. ExternE 2004) converge to the figure of 19€/tCO₂eq.

| | Response Total | Response Percent |
|-------------------|----------------|------------------|
| Fully disagree | 8 | 5% |
| Mostly disagree | 27 | 17% |
| Mostly agree | 87 | 52% |
| Fully agree | 27 | 17% |
| I don't know | 14 | 9% |
| Total Respondents | 166 | 100% |

Omission of non-monetisable damages

Not all damages considered important by some stakeholders are monetisable (at least at the present state of the research), or the monetary estimates may not reflect the severity of concerns of some groups and individuals (e.g. there are no relevant monetary evaluations of nuclear proliferation, security against terrorism or risk aversion; estimates of external costs associated with nuclear waste storage are very low). The omission of non-monetisable damages does not invalidate the use of monetisation for other damages where external costs can be estimated.

| | Response Total | % |
|-------------------|----------------|------|
| Fully disagree | 5 | 5% |
| Mostly disagree | 11 | 9% |
| Mostly agree | 57 | 44% |
| Fully agree | 47 | 36% |
| I don't know | 7 | 6% |
| Total Respondents | 130 | 100% |

5 Conclusions

The survey undertaken within the NEEDS project to assess stakeholders' Acceptance of the Externalities Concept provided significant results.

As outlined in the first section of the questionnaire, it seems that the majority of the respondents agree with the main principles which are at the basis of the externalities concept, such as the polluter pays principle, the monetisation and the government intervention.

Nonetheless a lower consensus has been expressed on the suitability to monetise all the external impacts of the human activities, some of which have also been accompanied by controversial opinions. In few words:

- there is a clear consensus on the monetisation principle;
- there is also a clear awareness of the limits of current research (uncertainties, wide range of results) which leads to definitive numbers;
- therefore, there are not clear prevalent positions on the possibility (or the impossibility) to monetise some risks and potentially dangerous activities.

As outlined in Section 2, which represented the more technical part of the questionnaire, only 56% of the respondents seem to have knowledge about the Impact Pathway Approach (IPA) and were able to provide their opinion on the reliability of the techniques used to quantify the externalities impacts. This is a sign that the answers to the overall questionnaire are more based on common sense than on a conscious knowledge of the external costs calculation system. Hence, given the general acceptance of both the approach and the results of the IPA (as pointed out in Section 4), it seems worth investing in further dissemination of this quantitative methodology.

Referring to those that answered to Section 2 of the questionnaire, it appears that a large majority (around 75%) agrees with the usefulness of the bottom-up methodology to estimate the external costs, especially for what concerns the possibility to use it in the cost benefit analysis. As for the hindering factors of the IPA, there is a large consensus to indicate the uncertainties of results, followed by the limited scope, as the most important obstacles for a wider diffusion of this methodology.

The general consensus on the importance of the externalities main principles manifested in Section 1, finds a confirmation in the answers provided in Section 3, concerning the use of the bottom up analysis results. Here the majority of the respondents (around 70%) agree that the IPA can provide a strong input to the formulation of environmental, energy and transport policies. Above all, respondents found it particularly useful to support investments decisions, to guide consumers' choices and to set environmental policies.

Not surprisingly, a lower consensus emerged on the usefulness of the IPA to estimate penalties and subsidies, which is strictly related to the internalisation mechanisms and which is in line with the doubts expressed on the suitability to monetise all impacts.

The answers provided to the first part of Section 4, where respondents were confronted with the ExternE results on the impacts of the various generation technologies, are quite homogeneous and they all seem to validate the research results. The nuclear technology represents the only exception as there is almost the same share of respondents stating that this technology has low external and explicitly the opposite.

Finally, the answers provided to the last questions of the questionnaire, concerning some practical implications of the current ExternE evaluation system, are mostly in favour of the use of the methodology. The IPA is considered from a large majority of the stakeholders to generally provide reliable appraisals. In addition, respondents seem to support the research efforts made to come up with standard results, which are based on some necessary approximations due to the IPA known constraints, such as the dependence to specific installations or sites or the uncertainties ranges.

6 APPENDIX 1 - The Questionnaire



NEEDS SURVEY ACCEPTANCE OF THE EXTERNALITY CONCEPT

AIM OF THE QUESTIONNAIRE

The main objective of the NEEDS project (New Energy Externalities Developments for Sustainability) is to evaluate the full costs and benefits (i.e. direct + external) of energy policies and of future energy systems, both at the level of individual countries and for the enlarged EU as a whole.

The project continues and extends the research path explored in the ExternE projects for the determination of external costs caused by the energy production and consumption.

The External costs estimates generated using the 'impact pathway approach' are highly attractive as they represent directly comparable aggregated measures of environmental system performance and therefore provide policy makers with a transparent scientific basis for energy and environment-related policy formulation.

Nevertheless, although research in energy externalities has been under way for many years, the use of total costs as an aggregate measure of sustainability performance is not universally recognised and their acceptance may vary between stakeholders and countries.

Internalisation policies are sometimes understood by the potential users as a means to levy additional taxes, and the benefits of such policies for society as a whole (improved sustainability, equity and market efficiency) are not widely understood and acknowledged. Moreover, the very notion of assigning a monetary value to specific social impacts, such as the risk of illness or the reduction of average life expectancy, generates some resistance.

In this respect, acceptability may represent a major barrier towards the increased use of internalisation policies, restraining policy makers from taking measures based on the monetary valuation methods.

The present questionnaire has been designed to explicitly assess stakeholders' acceptability of the externality principles and their use in energy policy making.

Structure of the questionnaire:

- A. The Concept of Externalities
- B. The Bottom-Up Approach to Estimating External Costs (Strong and Weak Points)
- C. The Use of Results
- D. The Results of the Assessment and their Implications

Profile

1. What is your familiarity with the external cost framework and results?

- None
- Low
- Medium
- High

2. Into what stakeholder category would you place yourself?*

- Energy Supply
- Energy Demand
- NGOs
- Governmental Energy & Environmental Agencies
- Regulators / Authorities
- Associations
- Politicians
- Researchers
- Consultants
- Other, please specify

3. What is your age?

- Less than 30
- 30-45
- 46-60
- More than 60

4. What is your maximum level of formal education?

- Secondary School
- University
- Masters
- Doctorate

5. Gender

- Male
- Female

THE CONCEPT OF EXTERNALITIES

“Many human activities, like electricity generation or transport, cause substantial environmental and human health damages, which vary widely depending on how and where these activities were generated. The damages caused are for the most part not integrated into the pricing system. Borrowing a concept from welfare economics, the part of these damage costs not covered by the polluters are termed externalities or external costs. Policy should aim to ensure that prices reflect total costs of an activity, employing taxes, subsidies, or other economic instruments to incorporate the marginal cost of damages in individuals ‘and firms’ decision making. This internalisation of external costs is intended as a strategy to rebalance the social and environmental dimension with the purely economic one, accordingly leading to greater environmental sustainability” (from the [ExternE](#) web site)

6. The “Polluter Pays Principle”

The principle that those causing pollution should pay the damage costs their emissions cause is generally accepted and has been applied to industries that produce harmful wastes. Do you agree or disagree that this principle should be also applied to other types of damage costs like those arising from climate change, air pollution, noise and landscape impacts, etc?

- Fully Disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

7. Monetisation

Do you agree or disagree with the idea that damages to the environment and human health caused by energy supply and/or use should also be expressed in monetary terms, e.g. EURO's?

- Fully Disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

8. Government intervention

Do you agree or disagree that externalities cannot be adequately internalized by voluntary industrial action and that government intervention is therefore necessary to internalize external effects?

- Fully Disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

SUITABILITY OF MONETISATION FOR DIFFERENT IMPACTS AND ACTIVITIES

Please provide your opinion on the relative possibility of monetising the impacts (question 9-12) and activities (questions 13-16) listed here.

9. *Loss of human lives*

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic
- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

10. *Loss of biodiversity*

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic
- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

11. *Damages to ecosystems*

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic
- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

12. *Global Warming*

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic
- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

13. *Nuclear proliferation*

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic
- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

14. *Security against terrorism*

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic
- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

15. *Nuclear waste storage*

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic
- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

16. *Security of supply of electricity*

- Monetisation is possible and present values are satisfactory
- Monetisation is possible, present methods are appropriate but values are still too uncertain
- Monetisation may be possible, but present methods are problematic

- Monetisation is not meaningful and is impossible as a matter of principle
- No opinion/don't know

THE BOTTOM-UP APPROACH

The "bottom up" approach to estimating external costs (strong and weak points)

To support the internalisation of external costs, socio-environmental damages must first be estimated and monetized. Within the "ExternE" projects a detailed bottom-up 'impact pathway' approach (IPA) has been developed to quantify externalities from energy conversion in monetary terms (in contrast to the top down approach and the avoidance cost method). These externalities may result from impacts on human health (including mortality and morbidity), impacts on ecosystems and biodiversity, and damages due to global warming.

The principal steps of this analysis are (shown in Figure 1):

- Emission: specification of the relevant technologies and the environmental burdens they impose (e.g. kg of NO_x per TWh emitted by a specific power plant technology).
- Dispersion: calculation of the change in pollutant concentrations in all affected regions (e.g. the incremental concentration of ozone, using models of atmospheric dispersion and chemistry for ozone formation due to NO_x).
- Impact: calculation of the dose from the increased exposure and calculation of impacts (damage in physical units) from this dose, using a dose-response function (e.g. the number of cases of asthma due to this increase in ozone).
- Cost: the economic valuation of these impacts (e.g. the number of cases multiplied by the cost of a case of asthma)

17. Have you heard about the Impact Pathway Approach?

If you answer "no", the questionnaire skips to session 'Use of results'

- Yes
- No

THE BOTTOM-UP APPROACH - Strong and weak points -

RELATIVE STRENGTHS

Below we have listed some statements about the strengths of the Impacts Pathway Approach used in ExternE, as compared to the top-down methodologies often used to account for socio-environmental damages. Please state whether

you fully agree, mostly agree, mostly disagree or fully disagree with these statements on the strength of the Impact Pathway Approach.

18. *Actual Damages*

The Impacts Pathway Approach is able to account for the actual damage of pollutant releases

- Fully Disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

19. *Cost-benefit Analysis*

The results of the Impacts Pathway Approach (i.e. the monetised impacts) can be directly used in cost-benefit analysis.

- Fully Disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

20. *Direct Comparison*

The Impacts Pathway Approach for estimating external costs uses a common metric (money), which allows the direct comparison of different types of damages, providing guidance on the relative necessity and priorities for mitigation.

- Fully Disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

21. Please score the relative strength of the abilities of the Impacts Pathway Approach listed below, from the most useful (score = 1) to the least useful (score = 3). Please try to avoid assigning the same score to the statements:

| | 1 | 2 | 3 |
|---|---|---|---|
| Actual damages (question no. 18) | | | |
| Cost-benefit analysis (question no. 19) | | | |
| Policy usefulness despite uncertainties (question no. 20) | | | |

RELATIVE LIMITATIONS

The external costs accounting framework is still subject to some limitations that affect its use for policy purposes. Please score the following limitations in accordance with your knowledge and experience from the most important (score = 1) to the least important (score = 5).

22. *Limited scope*

The externalities accounting framework is essentially limited to environmental externalities and normally does not cover impacts like the depletion of fossil fuels or the threat of terrorism.

- 1
- 2
- 3
- 4

23. *Uneven accuracy*

Not all the environmental externalities are dealt with at the same level of accuracy. Emissions relating to soil and water and the corresponding effects on ecosystem still need to be better analysed and accounted for

- 1
- 2
- 3
- 4

24. *Case specific results*

Careful thought needs to be given before generalising the results of externalities work, given that the results of each case study are context-specific.

- 1
- 2
- 3
- 4

25. Uncertainty of results

Despite research efforts aimed at improving estimates, the uncertainty range of monetisation results can still be large (especially for the statistical value of life and impacts from climate change due to greenhouse gas emissions).

- 1
- 2
- 3
- 4

26. Social issues and equity

Issues affecting social acceptance or social equity are usually not considered, or only to a very limited extent.

- 1
- 2
- 3
- 4

USING THE RESULTS

The Impact Pathway Approach has been applied in a large number of European and national studies to give advice to the formulation of environmental, energy and transport policies. For example:

| Policy choice | Information from the Studies |
|--|--|
| Emission limits, pollution taxes, tradable permits | External cost for each source and each pollutant |
| Public choice of technologies, e.g. coal, gas or nuclear | External costs, all fuel cycle stages |
| Dispatching of existing power plants | External cost for each plant |
| Green accounting | External costs, all emissions |

SUITABLE POLICY USES

For which of the following policy uses is the information provided by the external cost results best suited? Score the following options from the most important (score=1) to the least important (score=4). You can assign the same score to two or even all the options.

27. To guide investment decisions

If major electricity sources remain in public or quasi-public ownership, then the full social marginal cost of electricity by different sources could be used to plan future capacity, with preference being given to the source with the lowest social marginal cost. Where electricity is privately owned,

then full social marginal cost can be used by regulators to guide new investment or to act as an effective environmental tax, leaving the private owners to respond accordingly.

- 1
- 2
- 3
- 4

28. To guide decisions of consumers

If the prices consumers have to pay would include external costs, they would take account of the external costs in their decisions.

- 1
- 2
- 3
- 4

29. To estimate penalties and subsidies

To internalize external costs it is necessary to estimate environmental charges and the corresponding taxation schemes or to estimate the amount of subsidies given to environmentally friendly technologies.

- 1
- 2
- 3
- 4

30. To raise environmental awareness

This can be done simply by drawing attention to the fact that all energy sources have externalities which give rise to economically inefficient allocations of resources.

- 1
- 2
- 3
- 4

31. To help setting environmental policies

The basic principle would be that, as a first approximation, attention should be paid to those activities generating the highest externalities.

- 1
- 2
- 3
- 4

32. Could you suggest other types of policy use of external costs estimates?

THE ASSESSMENT AND IMPLICATIONS

More than a decade of research has resulted in detailed sets of data for impacts from a wide range of fuels, technologies and locations. The analysis of such data illustrates how the external costs of electricity generation can largely differ depending on the choice of fuel, the technology used and the specific site. The overall results can be described in the picture, although the ExternE methodology is aiming at site and technology-specific results more than generalised ones.

RELATIVE TECHNOLOGY RESULTS

Do you agree or disagree with the statements below relating to the diagram above to the right? If you fully or mostly DISAGREE, please explain why in the appropriate case.

33. *Coal and oil technologies*

Coal and oil technologies have the highest external costs

- Fully disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Why:

34. *Natural gas technologies*

Natural gas technologies have quite low external costs due to low air pollution and moderate external costs due to greenhouse gases.

- Fully disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Why:

35. *Renewable technologies*

Renewable technologies have mostly* low external costs (*exceptions are some biomass technologies)

- Fully disagree
- Mostly disagree

- Mostly agree
- Fully agree
- I don't know
- Why:

36. Nuclear energy

Nuclear energy has low external costs

- Fully disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Why:

THE IMPLICATION OF THE ASSESSMENT

Below we have listed some practical implications of the current ExterneE evaluation system. Please indicate your agreement or disagreement.

37. Site specificity v. country level application

One of the most frequent criticisms of the externalities accounting method is that: "The results of the externalities calculation are very often for specific installations and not appropriate for policy choices that require results applicable at a wider level (i.e. at the country level)". However, since 2004 research on externalities also provides this type of results for specific countries, making the estimates more suitable for general policy decisions concerning countries. Do you think this is the right way to go?

- Yes
- No
- I don't know

38. Cost of omitting externalities in decision-making

Despite the presence of uncertainties, external cost assessment provides decision makers with basic estimates to support their policy decisions. Without such estimates the social cost of a wrong choice could be very large and harmful

- Fully disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

39. Use of expert consensus v. uncertainty ranges

One way to be able to use the external costs method, in spite of uncertainties and large spread of results is to seek consensus on some “recommended” figures to be provided to policy makers or stakeholders instead of letting them choose among wide ranges. For example the range of costs for climate change damages from CO₂ and other greenhouse gases are very wide, but nevertheless recent studies (i.e. ExternE 2004) converge to the figure of 19€/tCO₂eq.

- Fully disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

40. Omission of non-monetisable damages

Not all damages considered important by some stakeholders are monetisable (at least at the present state of the research), or the monetary estimates may not reflect the severity of concerns of some groups and individuals (e.g. there are no relevant monetary evaluations of nuclear proliferation, security against terrorism or risk aversion; estimates of external costs associated with nuclear waste storage are very low). The omission of non-monetisable damages does not invalidate the use of monetisation for other damages where external costs can be estimated.

- Fully disagree
- Mostly disagree
- Mostly agree
- Fully agree
- I don't know
- Comments

7 APPENDIX 2 - The responses to the questionnaire

1

| What is your familiarity with the external cost framework and results? | | |
|---|----------------|------|
| | Response Total | % |
| None | 19 | 8% |
| Low | 49 | 20% |
| Medium | 98 | 40% |
| High | 82 | 33% |
| Total Respondents | 248 | 100% |

2

| Into what stakeholder category would you place yourself? | | |
|---|----------------|------|
| | Response Total | % |
| Energy Supply | 30 | 15% |
| Energy Demand | 12 | 6% |
| NGOs | 13 | 7% |
| Energy & Env. Agencies | 25 | 13% |
| Regulators | 9 | 5% |
| Associations | 14 | 7% |
| Politicians | 5 | 3% |
| Researchers | 47 | 24% |
| Consultants | 24 | 12% |
| Other | 21 | 11% |
| Total Respondents | 200 | 100% |

3

| What is your age? | | |
|--------------------------|----------------|------|
| | Response Total | % |
| less than 30 | 44 | 18% |
| 30-45 | 95 | 38% |
| 46-60 | 86 | 35% |
| more than 60 | 23 | 9% |
| Total Respondents | 248 | 100% |

4

| What is your maximum level of formal education? | | |
|--|----------------|---|
| | Response Total | % |

| | | |
|-------------------------|-----|------|
| Secondary School | 9 | 5% |
| University | 57 | 30% |
| Masters | 61 | 32% |
| Doctorate | 62 | 33% |
| Other | 1 | 1% |
| Total Respondents | 190 | 100% |
| (skipped this question) | 40 | |

5

| Gender | | |
|-------------------|----------------|------|
| | Response Total | % |
| Male | 197 | 79% |
| Female | 51 | 21% |
| Total Respondents | 248 | 100% |

6

| The "Polluter Pays Principle" | | |
|---|----------------|------|
| <p>The principle that those causing pollution should pay the damage costs their emissions cause is generally accepted and has been applied to industries that produce harmful wastes. Do you agree or disagree that this principle should be also applied to other types of damage costs like those arising from climate change, air pollution, noise and landscape impacts, etc?</p> | | |
| | Response Total | % |
| Fully Disagree | 7 | 3% |
| Mostly disagree | 6 | 3% |
| Mostly agree | 72 | 35% |
| Fully agree | 114 | 55% |
| I don't know | 0 | 0% |
| Comments | 8 | 4% |
| Total Respondents | 207 | 100% |
| (skipped this question) | 41 | |

7

| Monetisation | | |
|--|----------------|-----|
| <p>Do you agree or disagree with the idea that damages to the environment and human health caused by energy supply and/or use should also be expressed in monetary terms, e.g. EURO's?</p> | | |
| | Response Total | % |
| Fully Disagree | 7 | 3% |
| Mostly disagree | 12 | 6% |
| Mostly agree | 82 | 40% |
| Fully agree | 91 | 44% |

| | | |
|-------------------------|-----|------|
| I don't know | 3 | 1% |
| Comments | 11 | 5% |
| Total Respondents | 206 | 100% |
| (skipped this question) | 38 | |

8

| Government intervention | | |
|---|----------------|------|
| Do you agree or disagree that externalities cannot be adequately internalized by voluntary industrial action and that government intervention is therefore necessary to internalize external effects? | | |
| | Response Total | % |
| Fully Disagree | 2 | 1% |
| Mostly disagree | 13 | 6% |
| Mostly agree | 73 | 35% |
| Fully agree | 109 | 53% |
| I don't know | 3 | 1% |
| Comments | 6 | 3% |
| Total Respondents | 206 | 100% |
| (skipped this question) | 42 | |

9

| Loss of human lives | | |
|--|----------------|------|
| | Response Total | % |
| Monetisation is possible and present values are satisfactory | 12 | 6% |
| Monetisation is possible, present methods are appropriate but values are still too uncertain | 58 | 29% |
| Monetisation may be possible, but present methods are problematic | 85 | 42% |
| Monetisation is not meaningful and is impossible as a matter of principle | 38 | 19% |
| No opinion/don't know | 9 | 4% |
| Total Respondents | 202 | 100% |
| (skipped this question) | 46 | |

10

| Loss of biodiversity | | |
|--|----------------|-----|
| | Response Total | % |
| Monetisation is possible and present values are satisfactory | 3 | 1% |
| Monetisation is possible, present methods are appropriate but values are still too uncertain | 38 | 19% |

| | | |
|---|-----|------|
| Monetisation may be possible, but present methods are problematic | 113 | 56% |
| Monetisation is not meaningful and is impossible as a matter of principle | 33 | 16% |
| No opinion/don't know | 14 | 7% |
| Total Respondents | 201 | 100% |
| (skipped this question) | 47 | |

11 Damages to ecosystems

| | Response Total | % |
|--|----------------|------|
| Monetisation is possible and present values are satisfactory | 5 | 3% |
| Monetisation is possible, present methods are appropriate but values are still too uncertain | 48 | 31% |
| Monetisation may be possible, but present methods are problematic | 84 | 54% |
| Monetisation is not meaningful and is impossible as a matter of principle | 13 | 8% |
| No opinion/don't know | 6 | 4% |
| Total Respondents | 156 | 100% |
| (skipped this question) | 44 | |

12 Global Warming

| | Response Total | % |
|--|----------------|------|
| Monetisation is possible and present values are satisfactory | 11 | 5% |
| Monetisation is possible, present methods are appropriate but values are still too uncertain | 81 | 40% |
| Monetisation may be possible, but present methods are problematic | 87 | 43% |
| Monetisation is not meaningful and is impossible as a matter of principle | 17 | 8% |
| No opinion/don't know | 5 | 2% |
| Total Respondents | 201 | 100% |
| (skipped this question) | 47 | |

13 Nuclear proliferation

| | Response Total | % |
|--|----------------|----|
| Monetisation is possible and present values are satisfactory | 9 | 6% |

| | | |
|--|-----|------|
| Monetisation is possible, present methods are appropriate but values are still too uncertain | 28 | 18% |
| Monetisation may be possible, but present methods are problematic | 52 | 33% |
| Monetisation is not meaningful and is impossible as a matter of principle | 42 | 27% |
| No opinion/don't know | 25 | 16% |
| Total Respondents | 156 | 100% |
| (skipped this question) | 44 | |

14

| Security against terrorism | | |
|--|----------------|------|
| | Response Total | % |
| Monetisation is possible and present values are satisfactory | 3 | 2% |
| Monetisation is possible, present methods are appropriate but values are still too uncertain | 19 | 12% |
| Monetisation may be possible, but present methods are problematic | 50 | 32% |
| Monetisation is not meaningful and is impossible as a matter of principle | 56 | 36% |
| No opinion/don't know | 28 | 18% |
| Total Respondents | 156 | 100% |
| (skipped this question) | 44 | |

15

| Nuclear waste storage | | |
|--|----------------|------------------|
| | Response Total | Response Percent |
| Monetisation is possible and present values are satisfactory | 28 | 14% |
| Monetisation is possible, present methods are appropriate but values are still too uncertain | 61 | 30% |
| Monetisation may be possible, but present methods are problematic | 72 | 36% |
| Monetisation is not meaningful and is impossible as a matter of principle | 24 | 12% |
| No opinion/don't know | 17 | 8% |
| Total Respondents | 202 | 100% |
| (skipped this question) | 46 | |

16

| Security of supply of electricity | | |
|--|----------------|-----|
| | Response Total | % |
| Monetisation is possible and present values are satisfactory | 21 | 13% |

| | | |
|--|-----|------|
| Monetisation is possible, present methods are appropriate but values are still too uncertain | 61 | 39% |
| Monetisation may be possible, but present methods are problematic | 53 | 34% |
| Monetisation is not meaningful and is impossible as a matter of principle | 9 | 6% |
| No opinion/don't know | 14 | 9% |
| Total Respondents | 158 | 100% |
| (skipped this question) | 42 | |

17 Have you heard about the Impact Pathway Approach?

| | Response Total | % |
|-------------------------|----------------|------|
| Yes | 63 | 56% |
| No | 50 | 44% |
| Total Respondents | 113 | 100% |
| (skipped this question) | 87 | |

18 Actual Damages

The Impacts Pathway Approach is able to account for the actual damage of pollutant releases

| | Response Total | % |
|-------------------------|----------------|------|
| Fully disagree | 1 | 2% |
| Mostly disagree | 6 | 14% |
| Mostly agree | 28 | 67% |
| Fully agree | 5 | 12% |
| I don't know | 1 | 2% |
| Comments: | 1 | 2% |
| Total Respondents | 42 | 100% |
| (skipped this question) | 154 | |

19 Cost-benefit Analysis

The results of the Impacts Pathway Approach (i.e. the monetised impacts) can be directly used in cost-benefit analysis.

| | Response Total | % |
|-----------------|----------------|-----|
| Fully disagree | 1 | 2% |
| Mostly disagree | 8 | 19% |
| Mostly agree | 23 | 55% |
| Fully agree | 9 | 21% |

| | | |
|-------------------------|-----|------|
| I don't know | 0 | 0% |
| Comments: | 1 | 2% |
| Total Respondents | 42 | 100% |
| (skipped this question) | 158 | |

20

| Direct Comparison | | |
|--|----------------|------|
| The Impacts Pathway Approach for estimating external costs uses a common metric (money), which allows the direct comparison of different types of damages, providing guidance on the relative necessity and priorities for mitigation. | | |
| | Response Total | % |
| Fully disagree | 0 | 0 |
| Mostly disagree | 8 | 21% |
| Mostly agree | 14 | 37% |
| Fully agree | 13 | 34% |
| I don't know | 1 | 3% |
| Comments: | 2 | 5% |
| Total Respondents | 38 | 100% |
| (skipped this question) | 149 | |

21

| Please score the relative strength of the abilities of the Impacts Pathway Approach listed below, from the most useful (score = 1) to the least useful (score = 3). Please try to avoid assigning the same score to the statements: | | | | |
|--|-------------|----|--------------|----------------|
| | most useful | 2 | least useful | Response Total |
| Actual damages | 8 | 6 | 12 | 40 |
| Cost-benefit analysis | 10 | 13 | 3 | 40 |
| Direct comparison | 8 | 10 | 8 | 40 |
| Total Respondents | | | | 40 |
| (skipped this question) | | | | 160 |

22

| Limited scope | | |
|---|----------------|-----|
| The externalities accounting framework is essentially limited to environmental externalities and normally does not cover impacts like the depletion of fossil fuels or the threat of terrorism. | | |
| | Response Total | % |
| 1 | 7 | 17% |
| 2 | 16 | 39% |
| 3 | 6 | 15% |
| 4 | 10 | 24% |
| 5 | 2 | 5% |

| | | |
|-------------------------|-----|------|
| Total Respondents | 41 | 100% |
| (skipped this question) | 159 | |

23

| Uneven accuracy | | |
|--|----------------|------|
| Not all the environmental externalities are dealt with at the same level of accuracy. Emissions relating to soil and water and the corresponding effects on ecosystem still need to be better analysed and accounted for | | |
| | Response Total | % |
| 1 | 3 | 7% |
| 2 | 11 | 27% |
| 3 | 13 | 32% |
| 4 | 9 | 22% |
| 5 | 5 | 12% |
| Total Respondents | 41 | 100% |
| (skipped this question) | 159 | |

24

| Case specific results | | |
|--|----------------|------|
| Careful thought needs to be given before generalising the results of externalities work, given that the results of each case study are context-specific. | | |
| | Response Total | % |
| 1 | 9 | 22% |
| 2 | 15 | 37% |
| 3 | 6 | 15% |
| 4 | 5 | 12% |
| 5 | 6 | 15% |
| Total Respondents | 41 | 100% |
| (skipped this question) | 159 | |

25

| Uncertainty of results | | |
|---|----------------|-----|
| Despite research efforts aimed at improving estimates, the uncertainty range of monetisation results can still be large (especially for the statistical value of life and impacts from climate change due to greenhouse gas emissions). | | |
| | Response Total | % |
| 1 | 15 | 37% |
| 2 | 12 | 29% |
| 3 | 6 | 15% |
| 4 | 4 | 10% |

| | | | |
|-------------------------|---|-----|------|
| | 5 | 4 | 10% |
| Total Respondents | | 41 | 100% |
| (skipped this question) | | 159 | |

26

| Social issues and equity | | |
|---|----------------|------|
| Issues affecting social acceptance or social equity are usually not considered, or only to a very limited extent. | | |
| | Response Total | % |
| 1 | 4 | 10% |
| 2 | 10 | 25% |
| 3 | 15 | 38% |
| 4 | 9 | 23% |
| 5 | 2 | 5% |
| Total Respondents | 40 | 100% |
| (skipped this question) | 160 | |

27

| To guide investment decisions | | |
|---|----------------|------|
| If major electricity sources remain in public or quasi-public ownership, then the full social marginal cost of electricity by different sources could be used to plan future capacity, with preference being given to the source with the lowest social marginal cost. Where electricity is privately owned, then full social marginal cost can be used by regulators to guide new investment or to act as an effective environmental tax, leaving the private owners to respond accordingly. | | |
| | Response Total | % |
| 1 | 65 | 38% |
| 2 | 52 | 30% |
| 3 | 40 | 23% |
| 4 | 15 | 9% |
| Total Respondents | 172 | 100% |
| (skipped this question) | 76 | |

28

| To guide decisions of consumers | | |
|---|----------------|-----|
| If the prices consumers have to pay would include external costs, they would take account of the external costs in their decisions. | | |
| | Response Total | % |
| 1 | 72 | 41% |
| 2 | 59 | 34% |
| 3 | 23 | 13% |

| | | | |
|-------------------------|---|-----|------|
| | 4 | 22 | 13% |
| Total Respondents | | 176 | 100% |
| (skipped this question) | | 72 | |

29

| To estimate penalties and subsidies | | | |
|---|---|----------------|------|
| To internalize external costs it is necessary to estimate environmental charges and the corresponding taxation schemes or to estimate the amount of subsidies given to environmentally friendly technologies. | | | |
| | | Response Total | % |
| | 1 | 47 | 28% |
| | 2 | 68 | 40% |
| | 3 | 35 | 21% |
| | 4 | 19 | 11% |
| Total Respondents | | 169 | 100% |
| (skipped this question) | | 79 | |

30

| To raise environmental awareness | | | |
|---|---|----------------|------|
| This can be done simply by drawing attention to the fact that all energy sources have externalities which give rise to economically inefficient allocations of resources. | | | |
| | | Response Total | % |
| | 1 | 54 | 31% |
| | 2 | 50 | 29% |
| | 3 | 46 | 27% |
| | 4 | 23 | 13% |
| Total Respondents | | 173 | 100% |
| (skipped this question) | | 75 | |

31

| To help setting environmental policies | | | |
|---|---|----------------|------|
| The basic principle would be that, as a first approximation, attention should be paid to those activities generating the highest externalities. | | | |
| | | Response Total | % |
| | 1 | 72 | 41% |
| | 2 | 53 | 30% |
| | 3 | 35 | 20% |
| | 4 | 16 | 9% |
| Total Respondents | | 176 | 100% |
| (skipped this question) | | 72 | |

| | | |
|-----------|---|-----|
| 32 | Could you suggest other types of policy use of external costs estimates? | |
| | Total Respondents | 32 |
| | (skipped this question) | 216 |

| | | | |
|-------------------------|---|----------------|------|
| 33 | Coal and oil technologies | | |
| | Coal and oil technologies have the highest external costs | | |
| | | Response Total | % |
| | Fully disagree | 8 | 5% |
| | Mostly disagree | 8 | 5% |
| | Mostly agree | 76 | 45% |
| | Fully agree | 71 | 42% |
| | I don't know | 3 | 2% |
| | Why: | 4 | 2% |
| | Total Respondents | 170 | 100% |
| (skipped this question) | 78 | | |

| | | | |
|-------------------------|--|----------------|------|
| 34 | Natural gas technologies | | |
| | Natural gas technologies have quite low external costs due to low air pollution and moderate external costs due to greenhouse gases. | | |
| | | Response Total | % |
| | Fully disagree | 6 | 4% |
| | Mostly disagree | 35 | 21% |
| | Mostly agree | 80 | 47% |
| | Fully agree | 43 | 25% |
| | I don't know | 4 | 2% |
| | Why: | 2 | 1% |
| | Total Respondents | 170 | 100% |
| (skipped this question) | 78 | | |

| | | |
|----------------|--|----------------|
| 35 | Renewable technologies | |
| | Renewable technologies have mostly* low external costs (*exceptions are some biomass technologies) | |
| | | Response Total |
| Fully disagree | 5 | 3% |

| | | |
|-------------------------|-----|------|
| Mostly disagree | 6 | 4% |
| Mostly agree | 89 | 52% |
| Fully agree | 68 | 40% |
| I don't know | 1 | 1% |
| Why: | 1 | 1% |
| Total Respondents | 170 | 100% |
| (skipped this question) | 78 | |

36

| Nuclear energy | | |
|---------------------------------------|----------------|------|
| Nuclear energy has low external costs | | |
| | Response Total | % |
| Fully disagree | 52 | 28% |
| Mostly disagree | 36 | 19% |
| Mostly agree | 51 | 27% |
| Fully agree | 41 | 22% |
| I don't know | 6 | 3% |
| Why: | 1 | 1% |
| Total Respondents | 187 | 100% |
| (skipped this question) | 61 | |

37

| Site specificity v. country level application | | |
|---|----------------|------|
| <p>One of the most frequent criticisms of the externalities accounting method is that: "The results of the externalities calculation are very often for specific installations and not appropriate for policy choices that require results applicable at a wider level (i.e. at the country level)". However, since 2004 research on externalities also provides this type of results for specific countries, making the estimates more suitable for general policy decisions concerning countries. Do you think this is the right way to go?</p> | | |
| | Response Total | % |
| Yes | 87 | 69% |
| No | 12 | 9% |
| I don't know | 28 | 22% |
| Total Respondents | 127 | 100% |
| (skipped this question) | 73 | |

38

| Cost of omitting externalities in decision-making | |
|--|--|
| <p>Despite the presence of uncertainties, external cost assessment provides decision makers with basic estimates to support their policy decisions. Without such estimates the social cost of a wrong choice could be very large and harmful</p> | |

| | Response Total | % |
|-------------------------|----------------|------|
| Fully disagree | 10 | 6% |
| Mostly disagree | 5 | 3% |
| Mostly agree | 84 | 50% |
| Fully agree | 63 | 38% |
| I don't know | 3 | 2% |
| <u>Comments</u> | 3 | 2% |
| Total Respondents | 168 | 100% |
| (skipped this question) | 80 | |

39

Use of expert consensus v. uncertainty ranges

One way to be able to use the external costs method, in spite of uncertainties and large spread of results is to seek consensus on some "recommended" figures to be provided to policy makers or stakeholders instead of letting them choose among wide ranges. For example the range of costs for climate change damages from CO₂ and other greenhouse gases are very wide, but nevertheless recent studies (i.e. ExternE 2004) converge to the figure of 19€/tCO₂eq.

| | Response Total | % |
|-------------------------|----------------|------|
| Fully disagree | 8 | 5% |
| Mostly disagree | 27 | 16% |
| Mostly agree | 87 | 52% |
| Fully agree | 27 | 16% |
| I don't know | 14 | 8% |
| <u>Comments</u> | 3 | 2% |
| Total Respondents | 166 | 100% |
| (skipped this question) | 82 | |

40

Omission of non-monetisable damages

Not all damages considered important by some stakeholders are monetisable (at least at the present state of the research), or the monetary estimates may not reflect the severity of concerns of some groups and individuals (e.g. there are no relevant monetary evaluations of nuclear proliferation, security against terrorism or risk aversion; estimates of external costs associated with nuclear waste storage are very low). The omission of non-monetisable damages does not invalidate the use of monetisation for other damages where external costs can be estimated.

| | Response Total | % |
|-----------------|----------------|-----|
| Fully disagree | 5 | 4% |
| Mostly disagree | 11 | 8% |
| Mostly agree | 57 | 44% |
| Fully agree | 47 | 36% |

| | | |
|-------------------------|-----|------|
| I don't know | 7 | 5% |
| <u>Comments</u> | 3 | 2% |
| Total Respondents | 130 | 100% |
| (skipped this question) | 70 | |