External costs and their integration in energy costs

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NEWS

- A Workshop on this subject has been held in Brussels on 9 December 2005 with various scientists and DG representatives. See WWW.EXTERNE.INFO

- A new ExternE Methodology 2005 update

- A new ExternE Results 2005 update
  
  *To be published soon*
EXTERNAL COSTS

- Externalities are changes of welfare generated by a given activity without being reflected in the market prices.

- Energy externalities (like transport, industrial or agricultural externalities) are often negative and considered as a cost which is external because it is not paid by those who have generated it.

- A clear example of externality is the air pollution which increases hospital admissions for respiratory illness (pain and suffering, costs of healthcare, lost productivity).
EXTERNAL COSTS

- If “internalised”, external costs can help to move towards a more sustainable energy (or transport, industrial or agricultural) system.

- If not internalised and taking into consideration public goods (like air or soil or water quality) there is a sort of distortion of the market favouring non sustainable technologies.

- Alternative technology options can become competitive through the internalisation of external costs.
EUROPEAN RESEARCH EFFORT

- Energy externalities: a terminology entered in the European “jargon” and applicable to various policies: environment, energy, transport, taxation and state aid.

- A new way of thinking: taking care of social and environmental damages (“polluter pays” principle)

- Major advances in both research on energy externalities quantification and on policy implementation these last 15 years
EUROPEAN RESEARCH EFFORT

- Influence of SD and of public / social actions on the internalisation of energy externalities
- From the beginning of the 90’s: close to 15 M€ dedicated to research on energy externalities
- Scientific support to European policies
- EU reference at the world-level
- Multidisciplinary research consortium
- Genuine European methodology and approach
EUROPEAN RESEARCH EFFORT

- Verband der Elektrizitätswerke Österreichs (AT)
- Vlaamse Instelling voor Technologisch Onderzoek – VITO (BE)
- IER, Universität Stuttgart (DE)
- Risoe National Laboratory (DK)
- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas – CIEMAT (ES)
- National Technical University of Athens – NTUA (EL)
- Ecole des Mines de Paris - ARMINES (FR)
- EKONO Energy Ltd. (FIN)
- Technical Research Centre of Finland – VTT (FIN)
- Fondazione Eni Enrico Mattei (IT)
- Instituto di Economia delle Fonti di Energia – IEFE (IT)
- Energy Conversion Centre, University College Dublin (IRL)
- Vrije Universiteit Amsterdam – IVM (NL)
- ENCO Environmental Consultants (NO)
- Centro de Estudos em Economia da Energia, dos Transportes e do Ambiente (PT)
- Stockholm Environmental Institute (SE)
- AEA Technology plc (UK)
METHODOLOGY

- Quantification of impacts through the damage function or impact pathway approach

- Economic valuation obtained by the willingness to pay by the affected individual to avoid a negative impact

- Bottom-up methodology (technology characterisation) with a site-specific approach

- Comparison between different fuel-cycles and different types of burden and impact with a fuel-cycle
Sustainable Energy Systems

**METHODOLOGY**

**IMPACT PATHWAY ANALYSIS**

**SOURCE**
(specification of site and technology)
⇒ emission
(e.g., kg/yr of particulates)

**DISPERSION**
(e.g. atmospheric dispersion model)
⇒ increase in concentration at receptor sites
  (e.g., µg/m³ of particulates in all affected regions)

**DOSE-RESPONSE FUNCTION**
(or exposure-response function)
⇒ impact
(e.g., cases of asthma due to ambient concentration of particulates)

**MONETARY VALUATION**
⇒ cost
(e.g., cost of asthma)

**Function**
Dose-Réponse

**Impact vs. Dose**

- **Source**: Specification of site and technology
- **Dispersion**: Atmospheric dispersion model
- **Dose-Response Function**: Exposure-response function
- **Monetary Valuation**: Cost assessment
## METHODOLOGY MONETARY VALUATION

<table>
<thead>
<tr>
<th>Health end-point</th>
<th>Recommended central unit values in € price year 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of a prevented Fatality</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Year of Life Lost</td>
<td>50,000 / year lost</td>
</tr>
<tr>
<td>Hospital admissions</td>
<td>2,000 / admission</td>
</tr>
<tr>
<td>Emergency Room Visit for respiratory illness</td>
<td>670 / visit</td>
</tr>
<tr>
<td>General Practitioner visits:</td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>53 / consultation</td>
</tr>
<tr>
<td>Lower respiratory symptoms</td>
<td>75 / consultation</td>
</tr>
<tr>
<td>Respiratory symptoms in asthmatics:</td>
<td></td>
</tr>
<tr>
<td>Adults</td>
<td>130 / event</td>
</tr>
<tr>
<td>Children</td>
<td>280 / event</td>
</tr>
<tr>
<td>Respiratory medication use – adults and children</td>
<td>1 / day</td>
</tr>
<tr>
<td>Restricted activity days</td>
<td>130 / day</td>
</tr>
<tr>
<td>Cough day</td>
<td>38 / day</td>
</tr>
<tr>
<td>Symptom day</td>
<td>38 / day</td>
</tr>
<tr>
<td>Work loss day</td>
<td>82 / day</td>
</tr>
<tr>
<td>Minor restricted activity day</td>
<td>38 / day</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>190,000 / case</td>
</tr>
</tbody>
</table>
EU POLICIES
ENVIRONMENT

- To limit values for sulfur dioxide, nitrous oxides, particles and lead in the atmosphere
- To struggle climate change
- To combat acidification and eutrophication
- CAFE: Clean Air for Europe

“To ensure that those who cause injury to human health or cause damage to the environment are held responsible for their actions”
EU POLICIES
ENERGY

• Green paper: *Towards a European strategy for the security of energy supply* - COM(2000)769

  “*Fiscal instrument (…) should lead to the internalisation of damage caused to the environment*”


  “*The Community needs a real Community-wide debate on the different energy sources, including costs and contributions to climate change*”

• Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market - OJ L 283

  “*Need to internalise external costs of electricity generation*”
EU POLICIES
TRANSPORT


  “Towards modal rebalance and greater internalisation of external costs”


  “Charging for infrastructure use (...) is intended to provide positive economic incentives for transport operations through a structure which more effectively integrates external costs and infrastructure costs in transport prices”
Community guidelines on state aid for environmental protection - OJ C 37 (2001)

“The principle of prices to reflect cost states that the prices of goods or services should incorporate the external costs”

“Member States may grant operating aid to new plants that will be calculated on the basis of the external costs avoided (...)
The amount of the aid thus granted to the renewable energy producer must not exceed 5 eurocents/kWh”
EXTERNAL COSTS RESULTS
(comparison among technologies)

Air pollution impacts (PM$_{10}$) and other impacts

- Biomass technologies
- Nuclear technologies
- Wind technologies
- Natural gas technologies
- New Coal technologies
- Existing Coal technologies (no gas cleaning)

Greenhouse gas impacts

- LOW
- HIGH
EXTERNAL COSTS RESULTS
Air pollution external costs of electricity systems (based on average EU power plant and rest of energy chain)
### DAMAGES OF AIR POLLUTANTS IN THE EU (€/tonne) - CAFE

<table>
<thead>
<tr>
<th>NOx</th>
<th>SO$_2$</th>
<th>PM$_{2.5}$</th>
<th>VOC</th>
<th>NH$_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,200 - 11,000</td>
<td>5,400 - 16,000</td>
<td>25,000 - 72,000</td>
<td>920 - 2,700</td>
<td>10,000 - 30,000</td>
</tr>
</tbody>
</table>
Medium and long term energy research actions

- Fuel cells, including their applications
- New technologies for energy carriers, particularly $H_2$
- New and advanced concepts in renewable energy technologies
- Capture and sequestration of $CO_2$
- *Socio-economic tools and concepts for energy strategy*
- *Policy-orientated research*
FP7 (2007-2013)
COOPERATION - ENERGY

- Hydrogen and fuel cells
- Energy savings and energy efficiency
- Renewable electricity generation
- CO2 capture and storage technologies for zero emission power generation
- Renewable fuel production
- Clean coal technologies
- Renewables for heating and cooling
- Smart energy networks

Knowledge for energy policy making
CURRENT EUROPEAN RESEARCH TOPICS

- To define a methodology for ecosystem damages
- Effects from multi-media (air/water/soil) impact pathways
- Externalities from major accidents (cf. oil tankers)
- To evaluate fuel cycles in all Europe
- To pursue a stakeholder dialogue
- To assess new and emerging new technologies
- To address energy security of supply issues
- To evaluate long-term internalisation strategies
QUESTIONS

- What should be included in the “external costs” definition (security of supply, depreciation of infrastructure publicly funded, acidification, nuclear proliferation…)?
- Are there sufficient bottom-up studies (to cope with time and site variability) for each technology?
- Generalisation and transferability?
- How to pass the costs on to the users in a socially and politically acceptable way?
- Taxation or subsidy?
- How to use the money recovered from the internalisation of external costs?
QUESTIONS

- Political context and externalities (cf. nuclear and renewables)?
- National, EU or global « internalisation » (cf. competitiveness)?
- External costs vs. Subsidies (energy or social ones)?
- Communicate the uncertainties?
- Preference of the population with respect to different types of risks?
- Potential of technological progress?
CONCLUSIONS

- Are we ready to accept a reduction of the average life expectancy of the European population of around 5 months due to air pollution?

- Health impacts of air pollution from electricity and transport sectors are around 80 billions €, i.e. approximately equivalent to the EU budget (100 billions €)

- Internalising external cost of coal electricity would significantly increase its cost
CONCLUSIONS

● If “internalised”, external costs can help to move towards a more sustainable energy (or transport, industrial or agricultural) system

● If not internalised and taking into consideration public goods (like air or soil or water quality) there is a sort of distortion of the market favouring non sustainable technologies

● Alternative technology options can become competitive through the internalisation of external costs
INFORMATION AND SOURCES

- http://www.externe.info/
- Contacts: European Commission and EU RTD projects coordinators (IER, ARMINES, ISIS, University of Bath)