



Environmental Pollution: Measuring the Damage

Presentation to NDU Group

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Presentation Outline

- Financial analysis of projects
- Societal analysis of projects
- Environmental externalities from energy sector
- Calculation of damage costs
- Policies for “internalising” externalities
- Economics of hydrogen buses
- Energy security of supply



Financial v. Economic (Societal) Analysis

- Financial Analysis
 - Private net benefit of an investment
- Economic (or Societal) Analysis
 - Net benefit to society of an investment
- Societal Analysis = Financial Analysis
 - remove** Market distortions (taxes & subsidies)
 - add in** Net environmental impacts (generally negative), on a total lifecycle cost basis.



Environmental Externalities

- Definition

Benefits or costs generated as an unintended by-product of an economic activity that do not accrue to the parties involved in the activity, and where no compensation is paid.

- Environmental Externalities of Energy Use

Health damages from emission of pollutants

Damages resulting from emission of greenhouse gases



Calculation of Environmental Externalities from the Energy Sector

- Life cycle analysis: “cradle to grave” accounting of all energy and material flows (& hence pollutants).
- Quantify physical impacts in terms of monetary units: (¢/kWh or ¢/vkm)



Control and Damage Costs

- **Control Costs:** Cost to society of achieving a given standard that restricts the extent of the impact of a pollutant to an acceptable, or agreed, level.
- **Damage Costs:** Measure of society's loss of welfare resulting from the damage arising from a specific adverse environmental impact.



Damage from Emissions of Air Pollutants

Damage costs vary greatly due to:

- Vintage of combustion technologies
- Emission-reducing devices employed
- Population density in receptor area
- Fuel quality (particularly coal)

Other damage costs:

- Mining and fuel transport externalities (particularly accidents)



Calculation of Damage Costs

Sources of Uncertainty

- Dumb farmer assumption
- Methodological issues surrounding “Willingness to Pay” to avoid premature death and higher levels of morbidity
- Equity weighting
- Social discount rate over long time horizons



“Internalising” Externalities

- **Regulation:** Minimum standards (euro for diesel buses)
- **Carbon Taxes:**
 - Level of tax under uncertainty?
 - Recycling of tax revenues?
 - Distributional problems?
 - Higher order effects?
 - Avoidance of distortion?
- **Emission Trading:**
 - EU scheme from 2005
 - Some private company schemes (e.g. BP and Shell)



Cost of Energy Security (Oil)

- **Subsidies**
 - Stockpiles
 - Military Expenditure
 - Tax incentives and subsidies for domestic producers
- **Damage Costs**
 - Cost of supply disruption on oil price trajectory and consequent impact on GNP.



Energy Security of Supply I

Strategic Risks

- External events and circumstances that involve the risk of interruption to the supply of imported fuels

Domestic System Risks

- Inappropriate investment decisions in domestic energy infrastructure
- Technical failures
- Terrorism
- Social disruption (e.g. labour strikes)



Energy Security of Supply II

- Marked asymmetry : value of unit of energy delivered and the value of the same unit not delivered.
- Supply interruptions can swiftly lead to widespread economic dislocation due to difficulty/expense of energy storage.
- Resilience of energy systems to extreme events a major problem for industrialised societies.
- Is energy security a public good that should be provided by governments?



Hydrogen/Fuel Cell Bus



