The Social Costs of Energy Consumption

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***Rio 02* World Climate & Energy Event**
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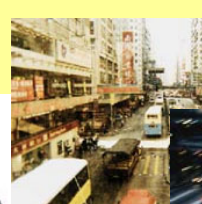
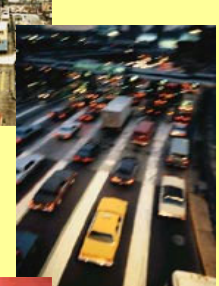
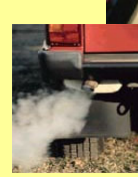
Bob Watson (Chairman of IPCC), Marrakech 2001:

The Challenge - Sustainable Management of an Ever-Changing Planet:

Sustainable Energy

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Why talk about 'Social costs'?

- **In market economies the structure and decisions of the energy system are determined by market prices and politics**
- **If we find substantial cost elements not reflected in market prices, decision makers get wrong signals and will take wrong decisions**
- **The larger the share of costs not reflected in the prices of any one energy technology, the more will be 'over' invested in such technology**
- **As these costs not reflected in prices typically are environmental or health costs, this has lead to non sustainable energy use in the past**

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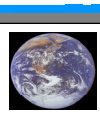

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What are 'Social costs'?

- **Definition:**
  - Social costs arise when any costs of production or consumption are passed on to third parties, like future generations or society at large.
- **Examples of social costs are:**
  - man-made climate change and its resulting damages
  - forest damages due to acid rain
  - health damages from major nuclear reactor accidents

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Social costs of climate change (Bob Watson, Chairman of IPCC, Marrakech 2001)**:**

- 'The Earth's climate is warming -- human activities are primarily responsible -- further climate change is inevitable without actions to reduce GHG emissions'
- 'Greenhouse gas emissions in the 21st century can set in motion large-scale, high-impact, non-linear, and potentially abrupt changes in physical and biological systems over the coming decades to millennia'
- 'Sustained warming of a few °C over millennia is projected to lead to an **increase in sea level of several meters** due to loss of Greenland and Antarctic Ice'

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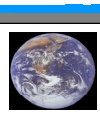

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Two definitions of costs not included in the prices:

External costs (neo-classical economic theory):

- **External costs + internal costs = social costs**
- **Aim:** Pareto-optimal allocation, maximum welfare
- External costs are used to find optimal levels of pollution ('arrange the deckchairs on the sinking Titanic')

Social costs (Hohmeyer/Kapp):

- **Social costs + private costs = costs to society**
- **Aim:** full internalisation of all effects not transported through prices to guide for sustainable development
- Given environmental and resource limitations social costs are used to secure a sustainable level of economic activity at minimal cost ('avoid sinking')

Concerning environmental and health damages both definitions coincide

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The two cost concepts and sustainable development:

- The concept of **external costs** is geared towards optimal economic welfare. It is blind for major aspects of 'strong' sustainability like the maximum sustainable scale of the economic system and intertemporal equity.
- The concept of **social costs** is broader by definition. It can include:
  - limits to scale of the economic system to reflect 'strong' sustainability
  - costs of keeping resource stocks functionally constant
  - structural economic effects
  - aspects of intergenerational and international equity in resource distribution.

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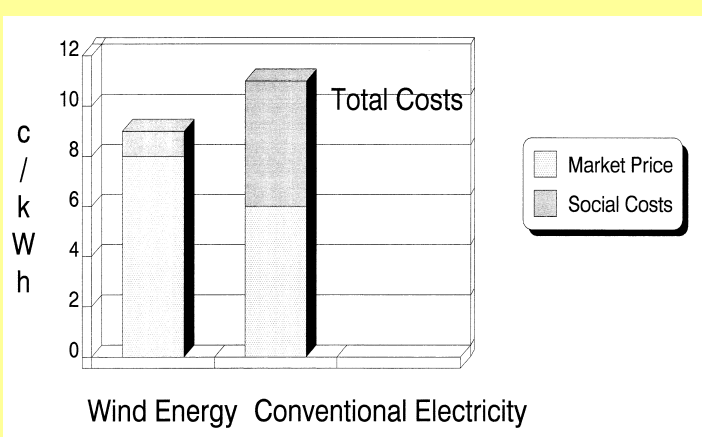
Market prices may lead to non sustainable energy systems if substantial differences in the social or external costs of different energy systems exist:



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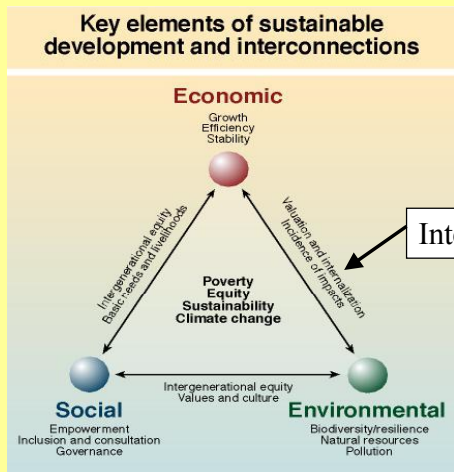
Since the early 1990s it has become a standard to demand the internalisation of such costs (include them in the prices)

Bob Watson (IPCC), Marrakech, 2001:



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Two basic questions on social or external cost of energy:

- Is there a substantial difference in the social costs of different energy systems?
- If so, does it impact on the competitive position of clean energy technologies?

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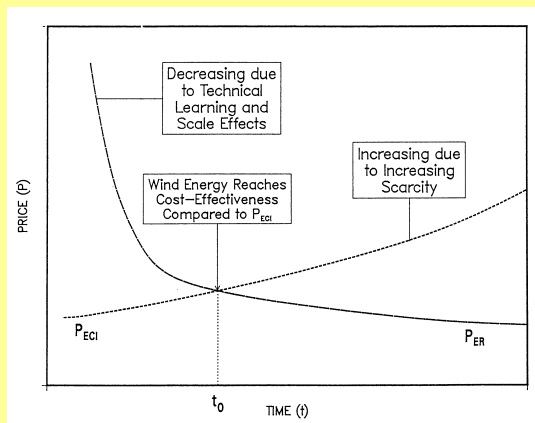
The methodological background of the analysis I:

Competitive position of a new versus an established technology



I. Cost Development of Electricity Generation Over Time
P_{ER}: Wind Energy
P_{ECI}: Conventional Electricity, Only Internal Costs

Source: Hohmeyer 1988

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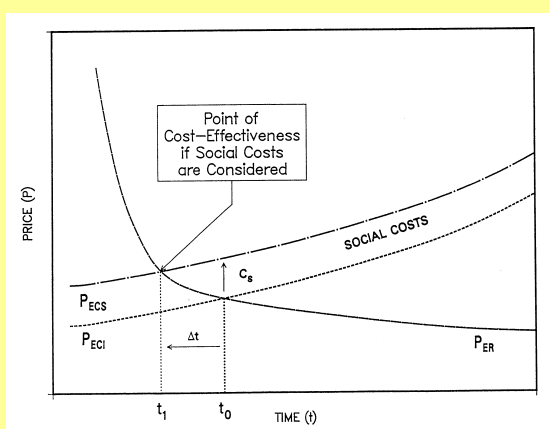
The methodological background of the analysis II:

Changed competitive position due to social costs



II. Cost Development of Electricity Generation Over Time
P_{ER}: Wind Energy
P_{ECS}: Conventional Electricity Including Social Costs

Source: Hohmeyer 1988

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Empirical research started about 15 year ago

- What do we know today?
- Where do we still need substantial research?
- Where do results converge?
- Where do we fundamentally disagree?
- What are latest results on social or external costs?
- What are the policy implications of our knowledge?

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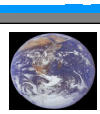

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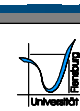

What do we know today?

Categories of social costs analyzed so far:

1. **Environmental damages** like:
   - Forest damages (flora)
   - Materials damaged (like buildings)
   - Global climate change (damage and mitigation cost)
2. **Human health damages**
3. **Structural macroeconomic effects**
4. **Intertemporal misallocation of resources**
5. **Subsidies** without adequate return

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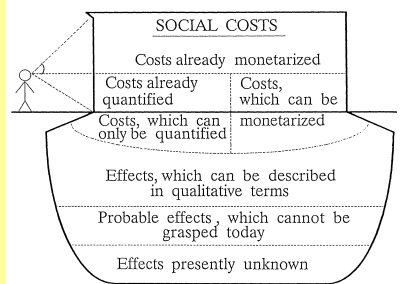
Where do we still need substantial research?

Categories of social costs insufficiently analyzed so far:

1. Long term damages of global warming
2. Full costs of nuclear accidents
3. Damages due to intermediate production
4. Damages presently unknown

The total social costs of electricity consumption can be compared to an iceberg :



Source: Hohmeyer 1988

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Where do results converge?

- Standard air pollutants
  - SO_2
  - NO_x
  - PM_{10}
- Impact pathway analysis
  - Health effects
  - Damages to flora and fauna
  - Material damages
- Use of contingent valuation methods

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Where do we fundamentally disagree?

- Use of social or external cost concepts
- Treatment of scale and equity
- Long term discounting of irreversible damages
- Discounting of damages to human health
- Valuation of loss of human lives in developing countries caused by global warming
- Treatment of nuclear risks

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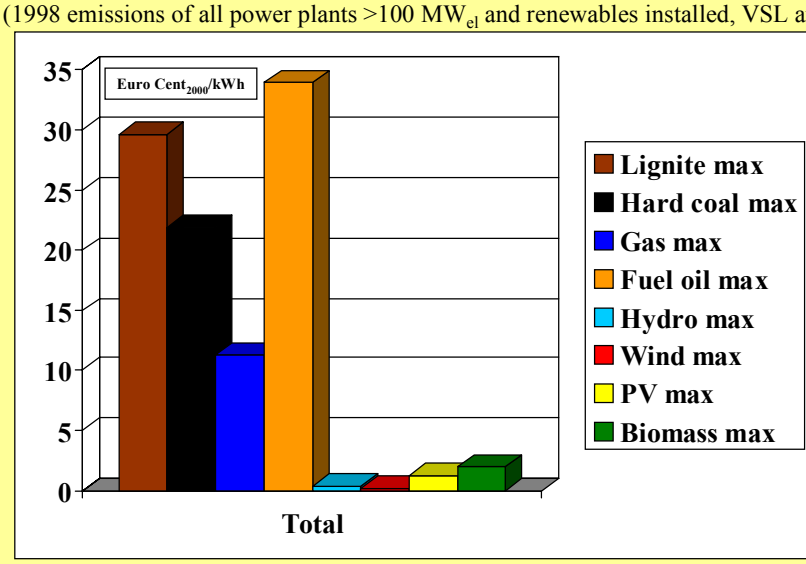
Latest results for Germany (Upper estimates)

(1998 emissions of all power plants >100 MW_{el} and renewables installed, VSL and 590 US$/tC)



1Euro Cent = 0. 9 USc

Source: Hohmeyer 2001

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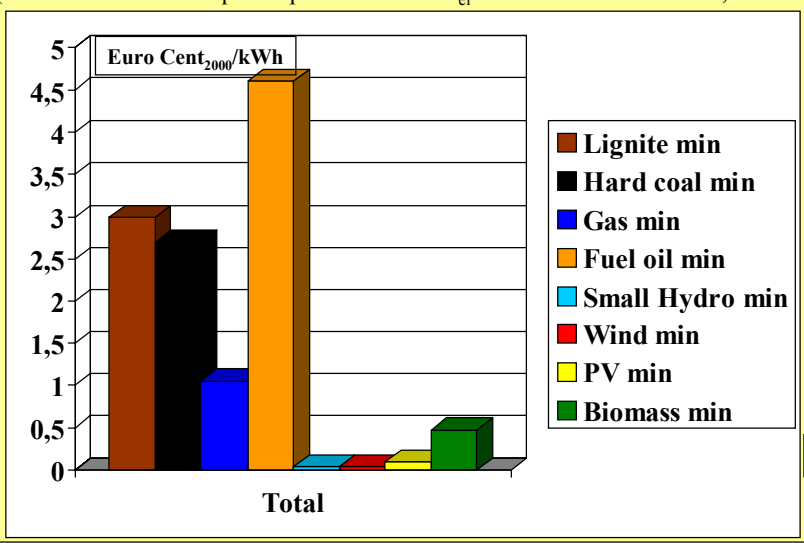
Latest results for Germany (lower estimates)

(1998 emissions of all power plants >100 MW_{el} and renewables installed, YOLL and 32 US$/tC)



1Euro Cent = 0. 9 USc

Source: Hohmeyer 2001

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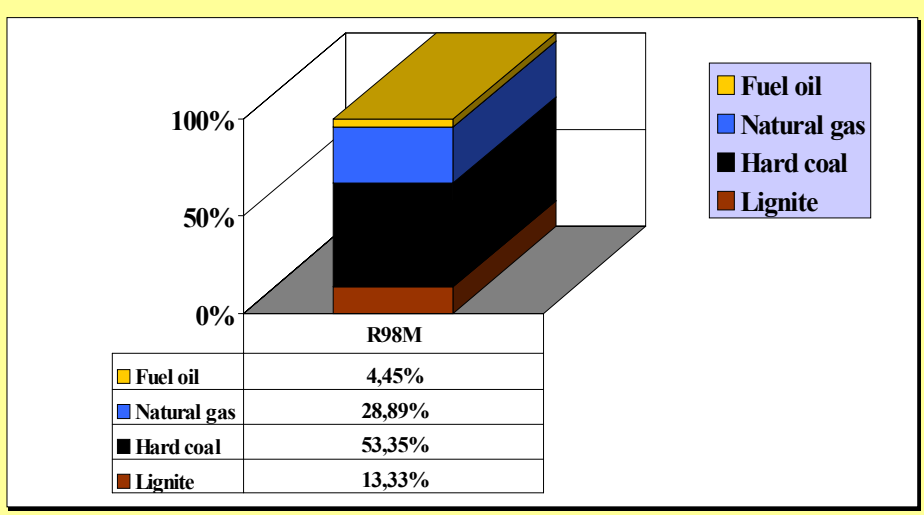
Intermediate load replaced by renewables in Germany 1998



	R98M
Fuel oil	4,45%
Natural gas	28,89%
Hard coal	53,35%
Lignite	13,33%

Source: Hohmeyer 2001

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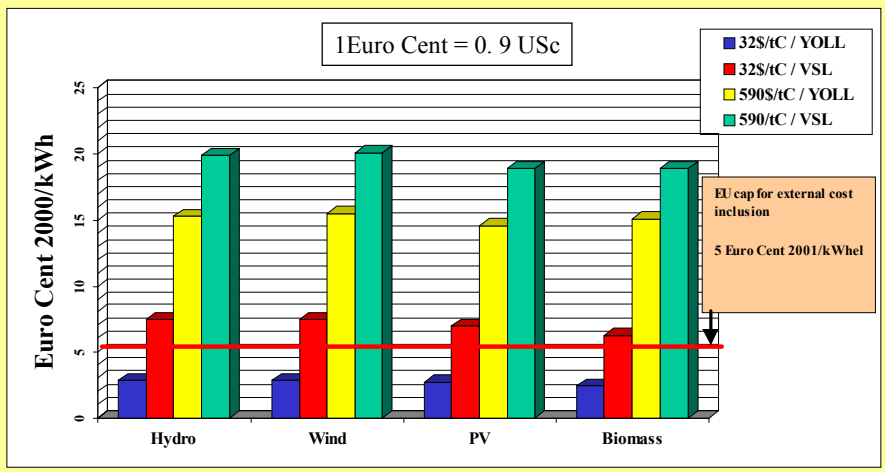
Net reductions in external costs by renewables

(1998 emissions of all power plants >100 MW_{el} and renewables installed)



Source: Hohmeyer 2001

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First conclusions

1 **The net external cost avoided by the use of renewable energy sources in Germany are still very substantial (mean value)**

Small hydro: 11.35 Euro Cent/kWh

Wind: 11.45 Euro Cent/kWh

PV: 10.80 Euro Cent/kWh

Biomass: 10.65 Euro Cent/kWh

2 **This is three to four times the substituted internal costs of conventional electricity generation replaced (about 3 Euro Cent/kWh)**

3 **Renewables should be paid 13.5 - 14.5 Euro Cent/kWh feed into the public grid in Germany**

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Policy responses and their impacts in Germany

1 Feed law 1991: 8.5 Euro Cent/kWh (instead of 3.5)

2 Renewable energy law 2001:

6.6 - 7.5 Euro Cent/kWh for small hydro

6.8 - 8.8 Euro Cent/kWh for wind energy

8.5 - 10 Euro Cent/kWh from biomass and

50 Euro Cent/kWh for photovoltaics

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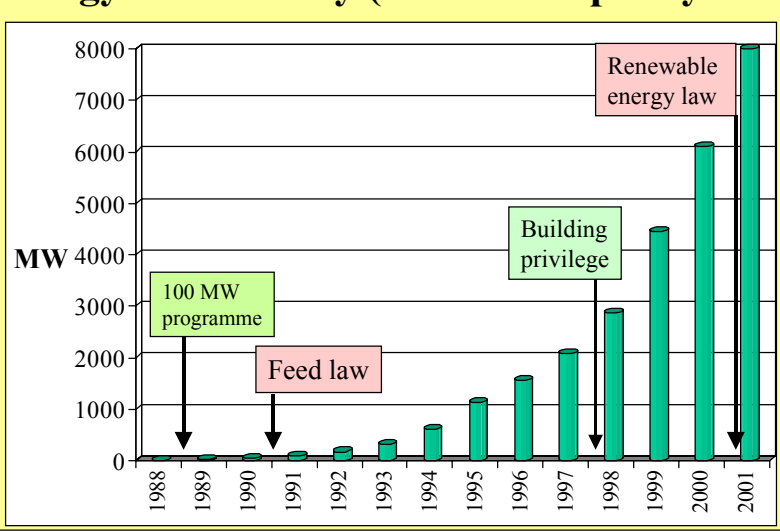
The impact of a first rough internalisation on wind energy in Germany (installed capacity in MW)



Source: BWE 2001

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Final conclusions

1 Even a rough internalisation of the difference in external or social costs may tip the balance for renewables

2 Wind energy has seen its break through in Germany due to a first internalisation

3 Biomass will experience a similar boom due to the new provisions of the Germany renewable energy law

4 Internalisation may be one way to switch to a sustainable energy future based on renewable energy sources