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## Fundamentals in environmental economics used for water planning and water policies

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**Baltic Sea Region**  
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# Introduction – water an unusual good



- “Free good” – in the past
- High exclusion cost resource
- Mobility giving problems indentifying and measuring
- Supply determined by natural forces
- Amount is crucial
- Markets are often non-existing or not operating effectively
  - Property rights incomplete or absent



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# The use and services of water



- The demand for water
  - as a commodity good in households, industry...
  - private & public environmental value as recreation, fish, wildlife habitat...
  - waste assimilation benefits
  - disbenefits of damage
  
- Depending on the use water can be rival or non-rival
  - rival – private good; drinking, cooking, sanitation...
  - non-rival – public good; recreation, aesthetic, waste sink



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# Water pollution

- **Point source;**
  - source easy to identify (pipes from industry or sewage treatment)
  
- **Non-point source; non-traceable, source hard to identify**
  - run-off from fields (livestock, fertilizers etc.)
  
- **Solutions to the market failure**
  - Regulatory
  - Economic incentives
  - Voluntary



# Regulation

The government TELLS the firms how to behave by setting;

- Point pollution;
  - Design standards
    - what technology to use (uniform)
  - Performance standards
    - How much the firms can emit (uniform, or vary according to location, age, pollution control history)
- Non-point pollution;
  - Physical restrictions on input

Non flexible



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# Economic incentives

Idea is to change the price the firms face, and thereby correcting the market failure.

- **Point pollution;**
  - Taxes; on each unit pollution
  - Subsidy; for the investment or per unit reduction
  - Tradable permits; upper bound for total emission – each firm can freely buy or sell permits
  
- **Non-point pollution;**
  - Tax on potential polluting inputs

**Flexible => reduced pollution for lowest cost**

# Voluntary reductions

Government initiate firms to undertake voluntary pollution control

- demonstrate that pollution control could save firms costs
- “green” image
- act now or be forced to later

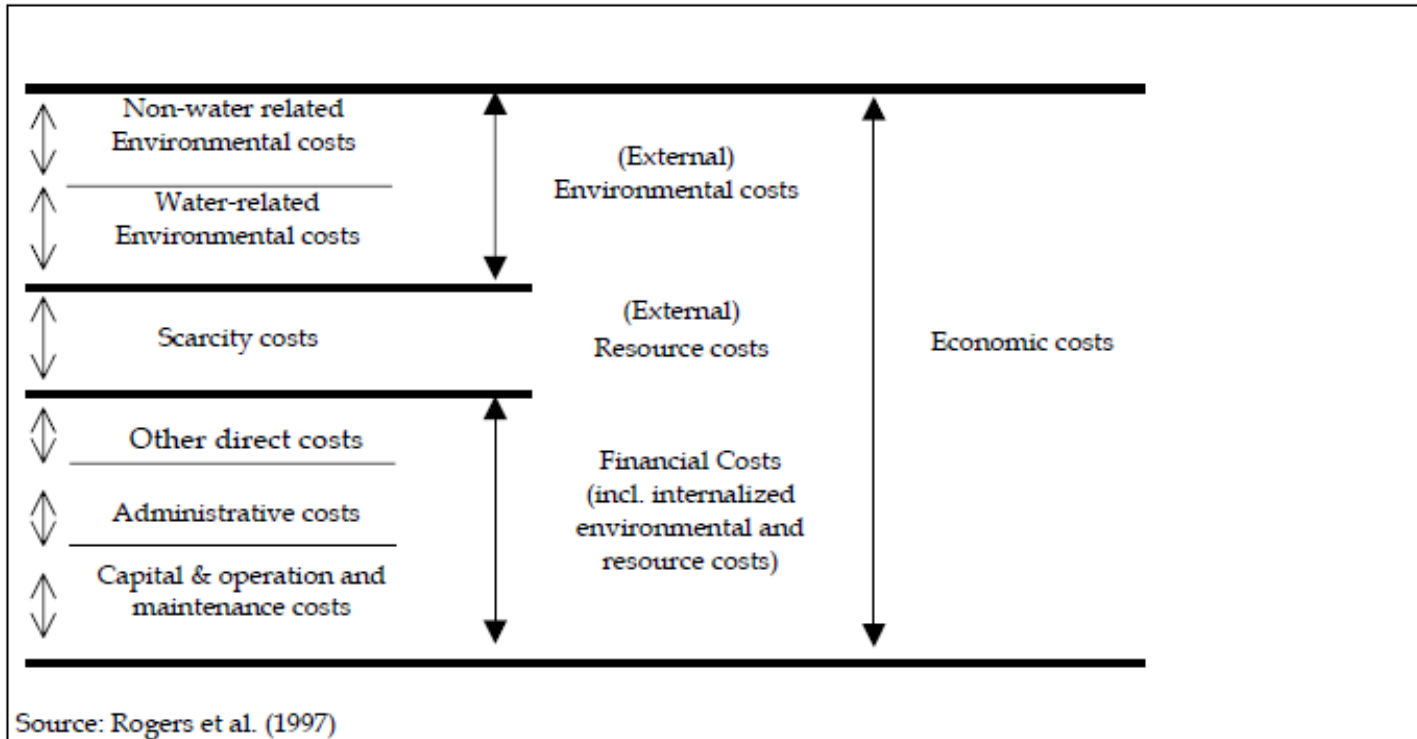


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# Definition of Costs (WFD)



# Approach...

Steps	Rationale
<i>1. Estimate financial costs</i>	Financial information is often more readily available than estimates of economic costs: as a result, they form a good basis for the analysis.
<i>2. Make transfers (such as taxes and subsidies) explicit</i>	Taxes only represent a transfer from society's point of view and should therefore be excluded from the economic analysis. However, environmentally related taxes might represent internalised environmental costs and should be accounted for as such.
<i>3. In case of distorted markets and scarce resources: replace market prices by opportunity (or resource) costs</i>	Because of distorted markets, market prices may not reflect the opportunity cost of the resource used, and therefore the benefits that could be achieved if the resource was assigned to its best available alternative use.
<i>4. Include all non priced environmental costs</i>	For non priced resources (and this is often the case for environmental resources), no price is paid as there is no market. To account for the total effect on welfare, these costs must be estimated and included.



# Step 1 Financial costs

- **Capital costs; purchase of equipment, land, start-up costs, legal fees etc.**
- **Operating costs; salary, electricity other costs that are necessary to keep the facility running**
- **Maintenance costs; to maintain assets in good functioning order**
- **Administrative costs; adm. costs related to water resource management**
- **Cost of capital/opportunity costs; estimate of rate of return by alternative action**
- **Depreciation; annualised cost of replacing existing assets in the future (historical, current or replacement)**
- **Other direct costs; mainly productivity loss**

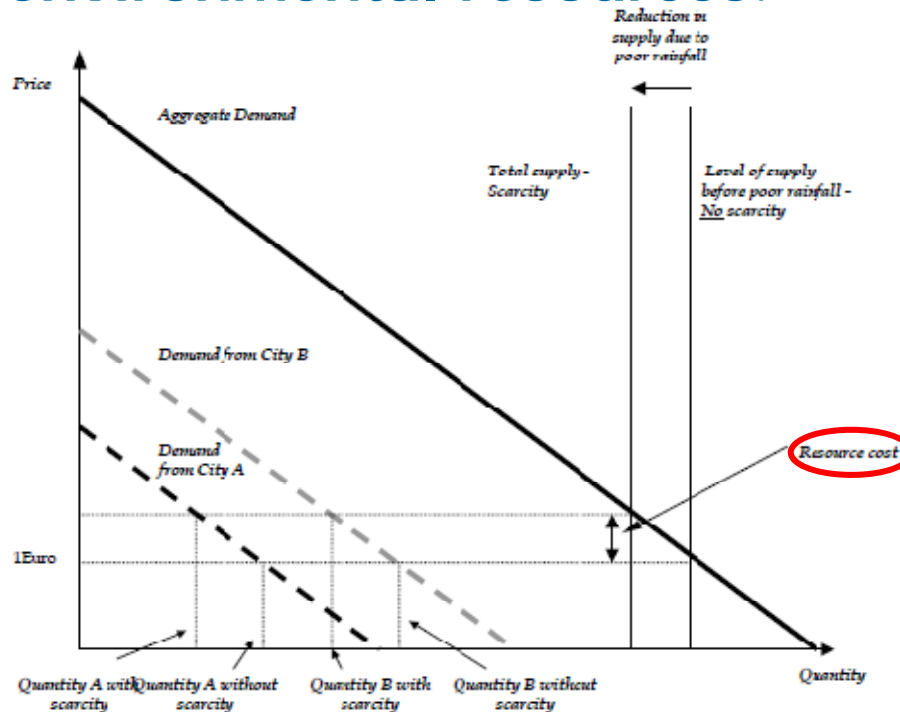
# Step 2 Market transfer

Steps	Rationale
<i>1. Estimate financial costs</i>	Financial information is often more readily available than estimates of economic costs: as a result, they form a good basis for the analysis.
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# Step 3 – resource costs

- The opportunity cost of the resource
- With well functioning market the cost would be reflected in the financial costs of the resource –often NOT so with environmental resources.



## Step 4 Non-priced environmental costs



- Cost of the damage on the environment, ecosystems and use-value for users
- Remember to take every linkage of the river basin district into account



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# How to choose...

## • Cost Effectiveness Analysis (CEA)

- An analysis of the costs of alternative programmes designed to meet **a single objective**.
- The programme which costs least will be the most cost effective.
- Cost-effective combination of measures: A combination of measures chosen subject to a costeffectiveness analysis

## • Cost Benefit Analysis (CBA)

- An analysis the aggregate costs and benefits (possible of several alternative programmes with **different objectives**).
- The programme with the best result is chosen.



# Tools

- **Discount rate:** the rate used for discounting future values to the present. (3.5 – 5.5%)
- **Annualising:** Dividing large investments over a lifetime.



# New words

- Unit cost: The cost of producing one unit of a product.
- Utility; The satisfaction derived from an activity, particularly consumption
- Production cost; directly attributable to the cost of producing one unit of a particular output.
- Financial costs; of water services include the costs of providing and administering these
- services. They include all operation and maintenance costs, and capital costs (principal and interest payment), and return on equity where appropriate).
- Operating costs All costs incurred to keep an environmental facility running (e.g. material and staff costs).
- Opportunity costs The value of the alternative foregone by choosing a particular activity
- *Indirect costs* are the economic costs for other sectors likely to result from the change in water status, such as a loss in productivity...
- *Induced costs* are the costs resulting from second-order effects, such as the reduction in employment in the service sectors in rural areas resulting from a loss in employment in the agricultural sector due to water degradation
- Resource costs: Represents the costs of foregone opportunities which other uses suffer due to the depletion of the resource beyond its natural rate of recharge or recovery

- External cost: An external cost exists when the following two conditions prevail
  1. An activity by one agent causes a loss of welfare to another agent; and
  2. The loss of welfare is uncompensated.



# Thank you!



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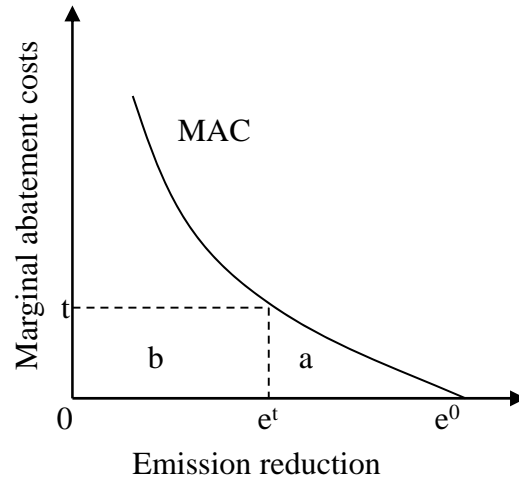
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# How does a tax work?

- $t = \text{MAC}$



# Abatement costs

- MAC is the marginal abatement cost per percent reduction (taking all possibilities into account)
- The area "a" gives total abatement costs for at 25% reduction

