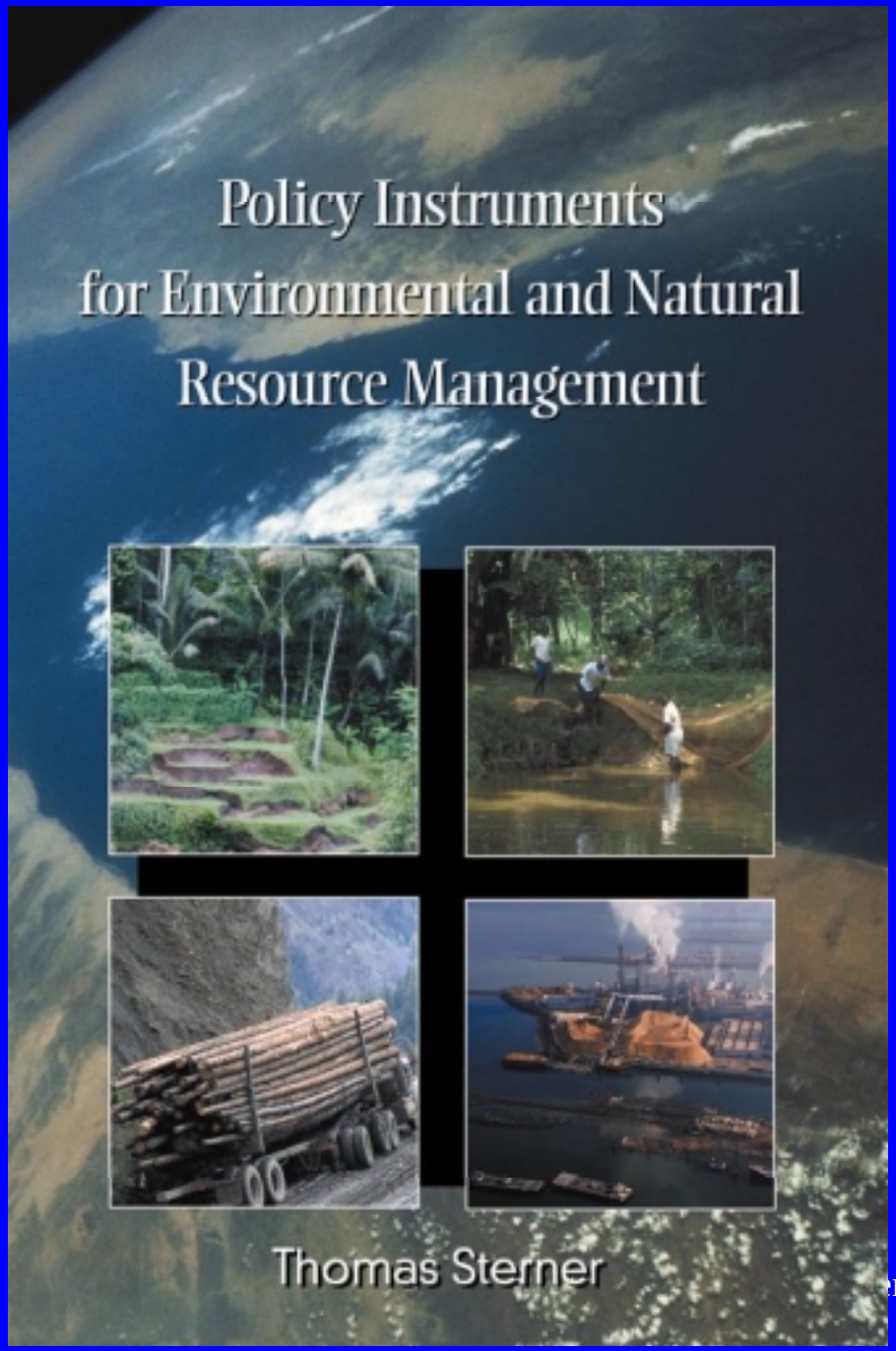
Tallinn Nov 4, 2003

Economic Instruments and Sustainability

Thomas Sterner

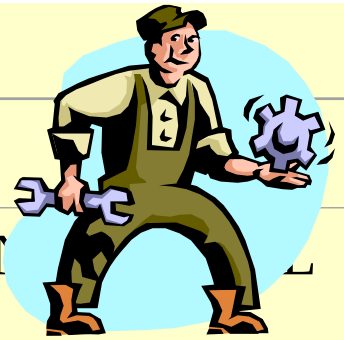


Published by RFF & World Bank.

- The need for policy
- The menu of instruments
- Theory of Instrument selection and design
- Application to Transport
- Application to industry
- Application to natural resources

Covers both US, Europe, other OECD, developing and transitional countries

THE TOOL KIT



PRICE-TYPE	RIGHTS	REGULATION	I
Taxes	Property rights	Technological Standard	Public participation
Subsidy (Reduct.)	Tradable permits	Performance Standard	Information disclosure
Charge, Fee/Tariff	Tradable Quotas	Ban	Voluntary Agreement
Deposit-refund	Certificate	Permit	Liability
Refunded Charge	CPR	Zoning	

Criteria

- Effectiveness
- Static Efficiency
- Dynamic Efficiency
- Fairness (Distribution of costs/benefits)
- Incentive compatibility
- Political feasability
- Instrument costs and information needs

Conditions (Ecol. or economic)

- Heterogeneity in abatement costs
- Heterogeneity in damage
- Uncertainty/Risk
- Asymmetric information
- Monopoly or oligopoly
- Synergies or ecological thresholds
- Non-point pollution

Property Rights are Fundamental

- It is not just a technical matter of finding an instrument that is ”efficient”. Taxes and permits are essentially a matter of **property rights**. Issues of ownership and of the incidence of costs are more important than technical issues concerning trading etc.

Overview Energy in Sweden

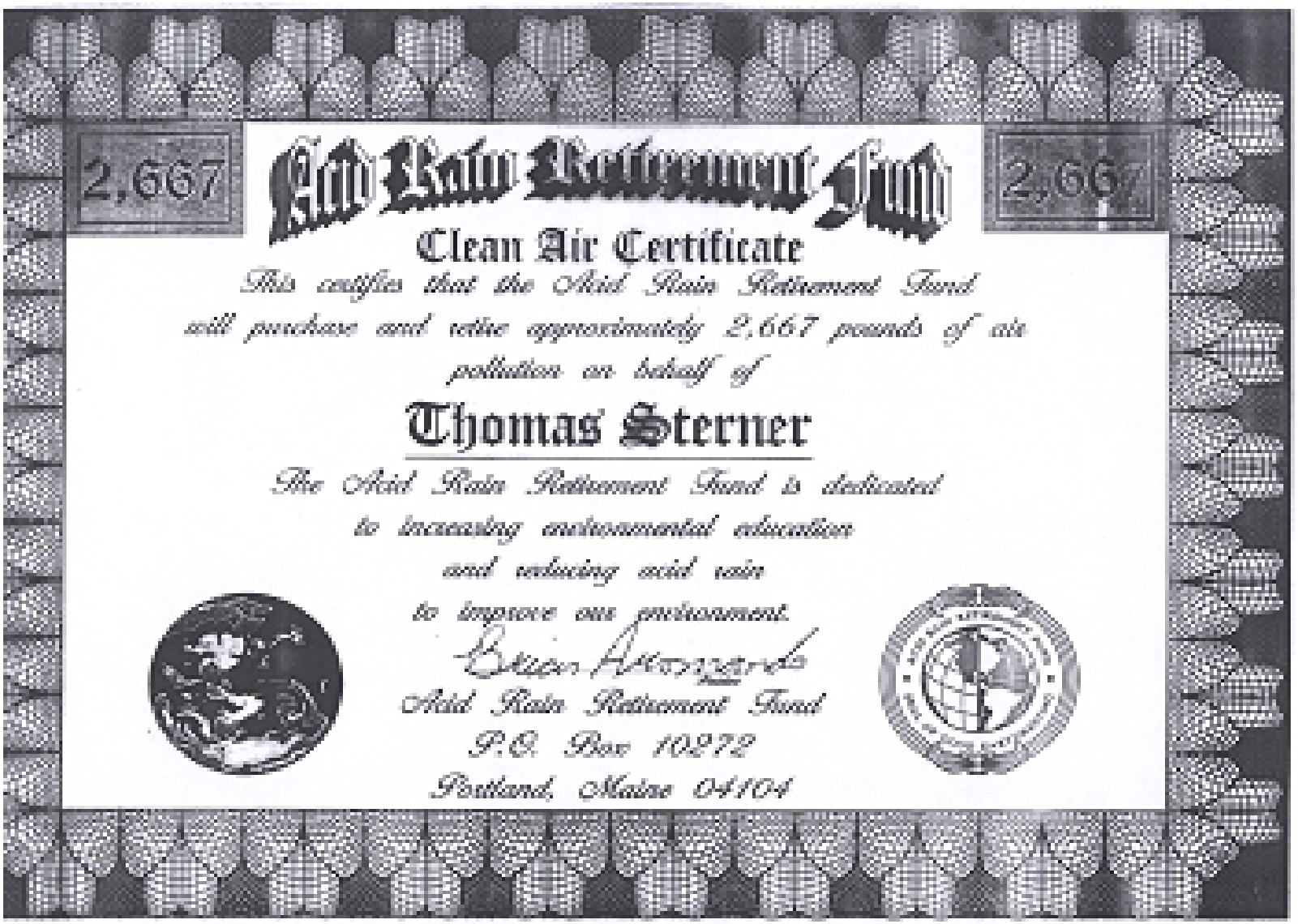
- Plentifull Hydro (70 TWh 9Mcap)
- Plentifull biomass, cool weather and many cogeneration-CHP-district heating opportun
- LARGE heavy industry (steel & paper), accustomed to low energy prices due to hydro
- Largest nuclear program, very contentious

Overview Policy in Sweden

- High taxation of energy for households
- Pretty high for industry too – but exceptions
- Energy savings and alternative fuel programs often a solution to pol dilemma
- High appreciation of taxes which are given central but not unique role as instruments

Overview rest of presentation

- Purpose: to discuss instruments, matters of principle or theory as well as practical experiences comparing Sweden to others.
- Illustration from Swedish Energy Sector
- Sulphur and Nox policies
- Other policies: certificates, e-efficiency
- Carbon and energy taxes, carbon trading



Sterner Environmental Policy Making

Different types of Permit

- Originally add-on to regulation: Grant rights and people trade in over-fullfilment ERCs
- Output allocation or relative target programs such as Greencertificates
- Cap and Trade. Decide maximum (CAP) for pollution and let market work. Less transaction costs.

Allocation of permits

- Permits can be allocated in proportion to:
- Historical pollution: Grandfathering
- (Historical/)current production: Output allocation or benchmarking.
- Equally
- By WTP ie through an auction
- NB Duration, bankability, updating…

How do taxes and permits work?

A tax has (at least) 3 effects:

- Provide incentive for abatement/ fuel subs
- Add to price of good→ less demand for those goods (and more for clean goods)
- Raise tax revenue →lower other taxes, good spending or less deficit

Permits the same if auctioned, sold or granted in **fixed** quantity. (NOT relative targets)

Some other rules of Instrument selection and design 1

- If abatement possibilities are limited then a higher product price caused by a tax will lower consumption to a socially optimal level. This **OUTPUT** effect is very desirable. Except in a number of cases such as small open economies where the products will just be imported
- Also with monopolies: taxes are perverse because monopolies alreay have too high prices and too low output.

SULFUR: Permits vs Taxes

- Permits have been very successful in abatement of Sulfur in the US
- Reduction by 50% in CAAA. 19-10 Gtons
- Estimated costs 600-1000 $/t.
- Actual prices per permit around 100-150!
- In Sweden tax works well too. T=1500 $/t
- Why HIGHER?

Swedish Nox Policy

- Very high tax required but not politically feasible.
- Refunded emission Payment used instead
- Has led to rapid reduction (40%) in Nox emissions which are now very much lower than in other countries

REP

- Each company pays a fee of 5 €/kg
- Money is refunded to same industries
- *Don’t get back what you paid!*
- …but a share in total fees proportional to your share in useful output, (energy)
- Incentive for technical abatement is like tax
- No price or budget effects

PROPERTIES OF REP

- Somewhat similar to tax on excess pollution
- Or tax-subsidy (tax above ê, subsidy below)
- Or to fees that go to earmarked funds
- Very useful when output effect **not** wanted
- Small open economy (competitivity issues)
- Targetting of only some industries
- Compact lobby of powerful polluters

Political economy of REP

- Splits the industry lobby
- Half the firms gain!
- Other half pays less than with same tax
- Less lobbyig means a higher **fee rate**
- **In Sweden we would only have passed a tax of maybe 0.5 € and abatement incentives would have been much lower!**

Swedish Energy & Carbon Taxes

- Current system (since about 10 years):
- Energy and Carbon (+ S, N) tax for all fuels
- Biofuels 0 tax (except for N-fee)
- Electr only energy tax (no tax on fuels used)
- Carbon tax is 760 SEK - 100 €/ton CO2
- 1000 litres fuel would have a C tax 230€ plus an energy tax in {100-200} dep on env
- Industry: general red 75% for C and 100 for electr
- Special red by caps of .8% and 1.2% of sales
- Heat production has special rules –50%

Some effects

- Dramatic increase in bioenergy within the district heating (some 25TWh in 10 yrs)
- Some, but insufficient improvement in energy efficiency
- 0 energy houses
- Norwegian sequestration of carbon in Ekofisk aquifer under N Sea.

Problems & suggested reform

- Heavy lobbying from industry
- Reductions of energy tax by industry or by sector is not acceptable to EU. ””subsidy””
- Perverse Result :whole tax must be lowered
- New rule C tax 190 SEK/ton 20-25 €/ton
- General cap of 0,7% sales
- (financed by raising tax on labour, petrol..)

Sweden and Carbon Trade

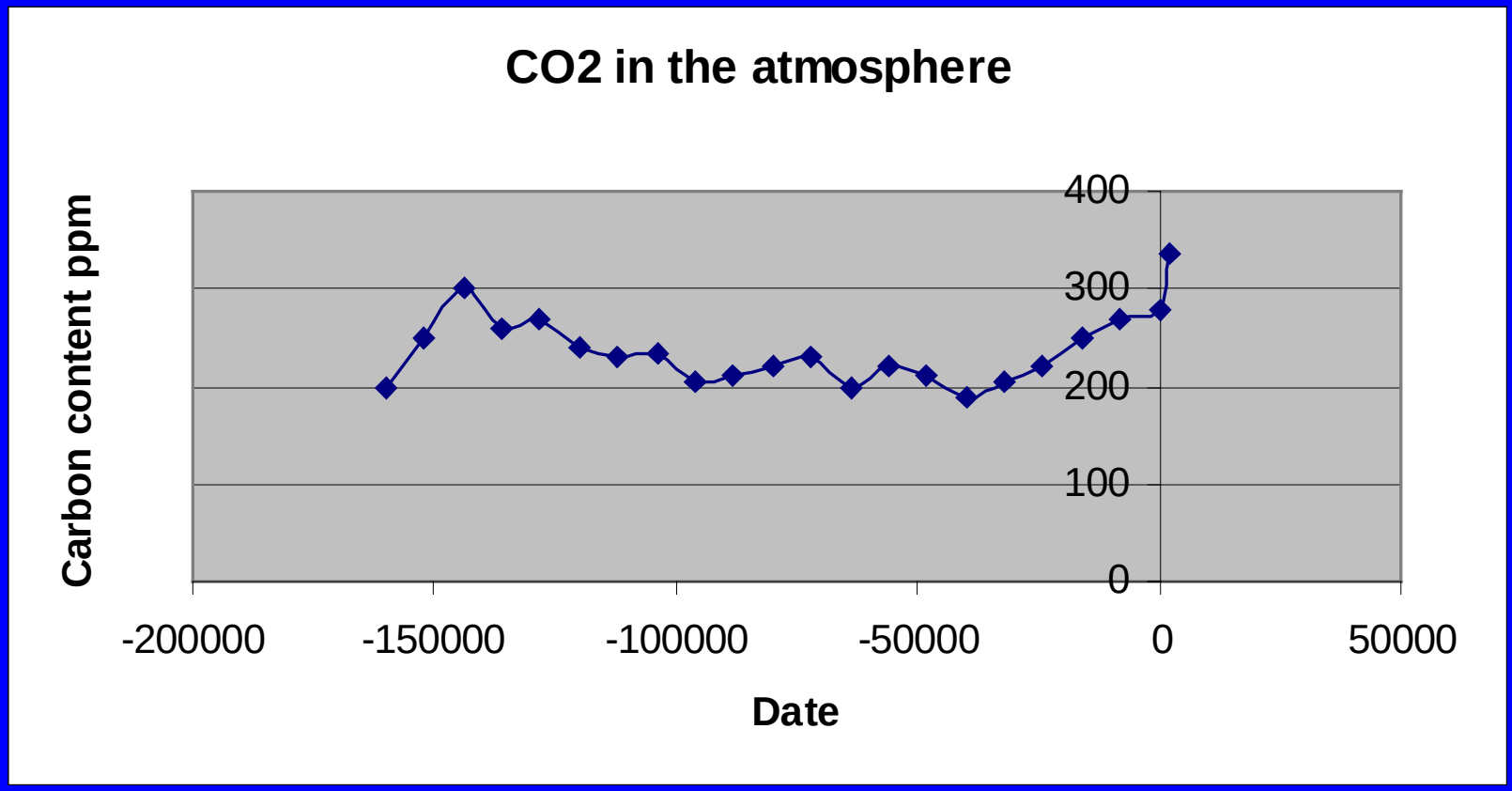
- Sweden has right to +4% but nat goal –4%
- 2005-7: 300 plants to be included. Free P
- The trading sector now emits 18.3 Mtons
- Suggested allocation 24 Mtons
- Not a good step towards meeting a red 4%!
- Trouble is national goverments handing out ”free money”.

Other energy policies in Sweden

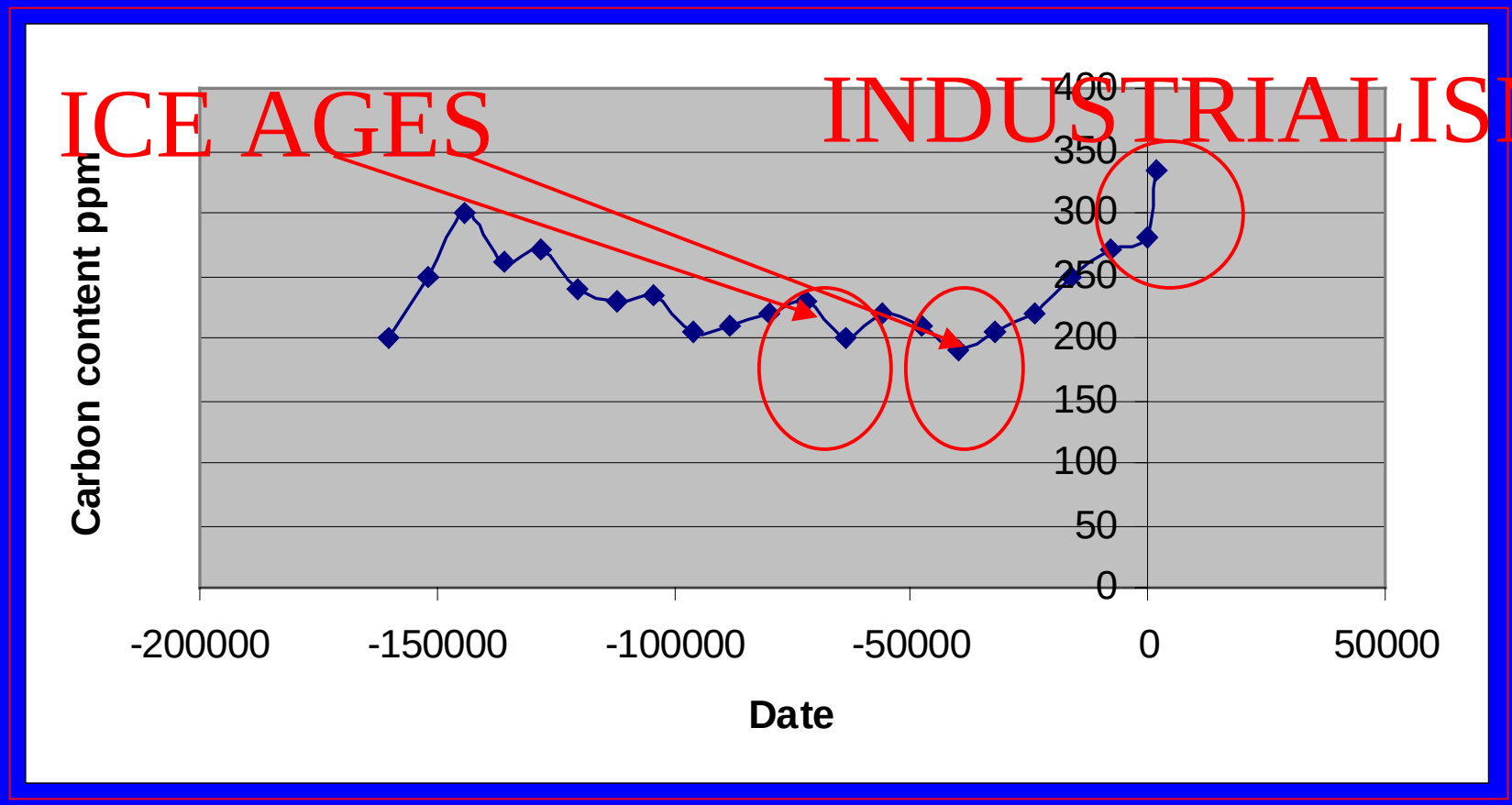
- Many hundreds of millions wasted in energy subsidies for building sector etc
- Local investment funds. Almost 1 Billion € (!)
- Certificates have been introduced for renewables. Might be more succesful but note that biomass came anyway due to tax!

END

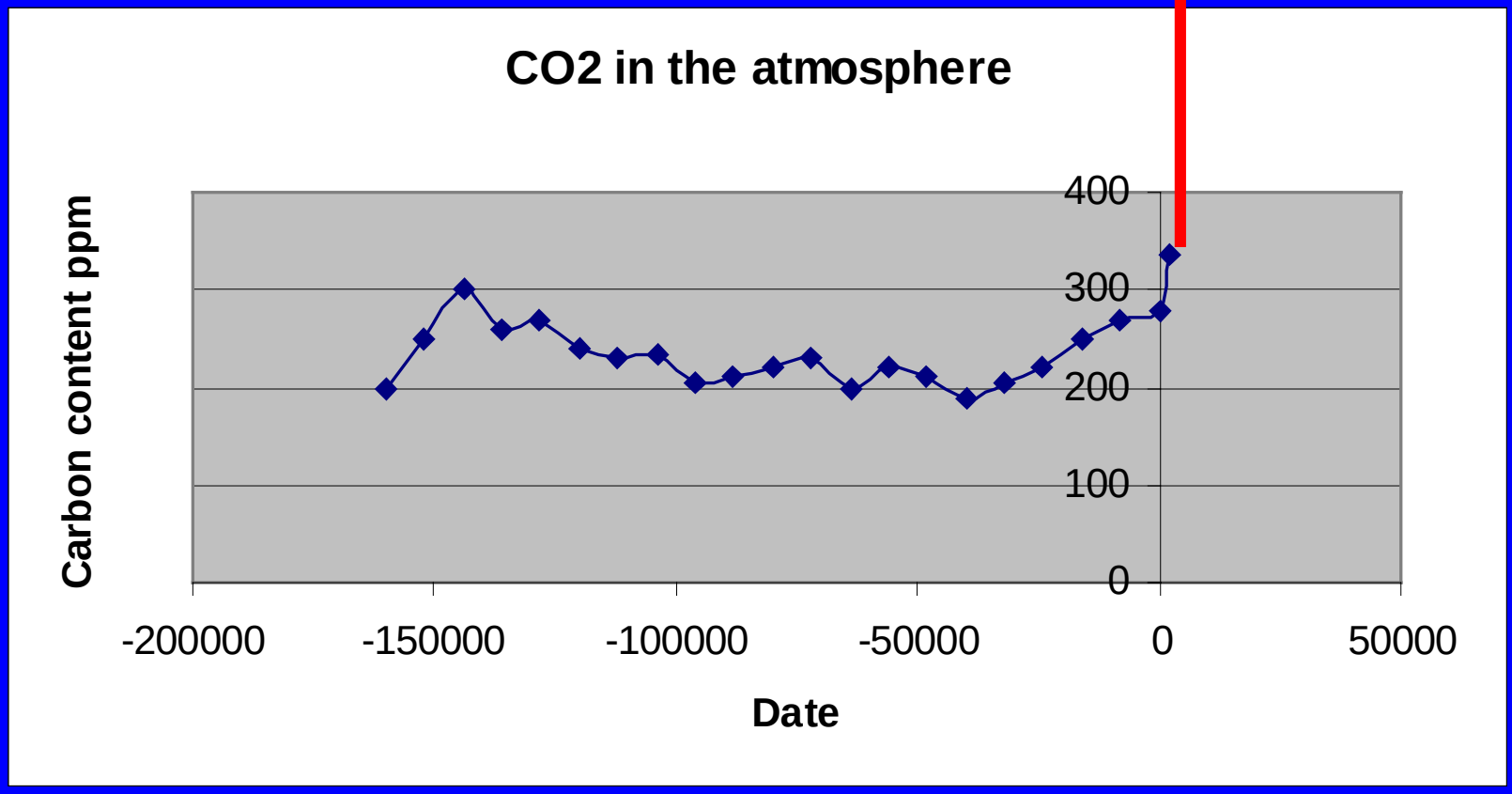
Global Warming



Global Warming

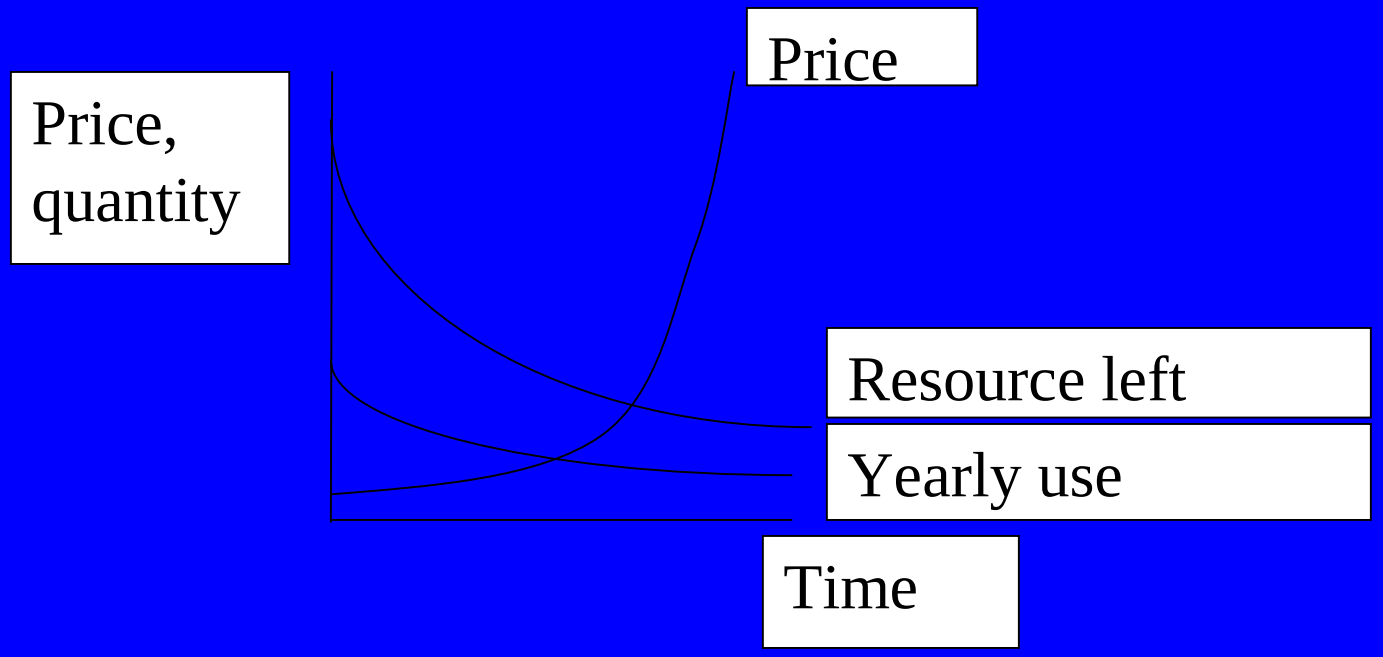


EU **radicalism**: Target **550** ppm



Market Mechanism

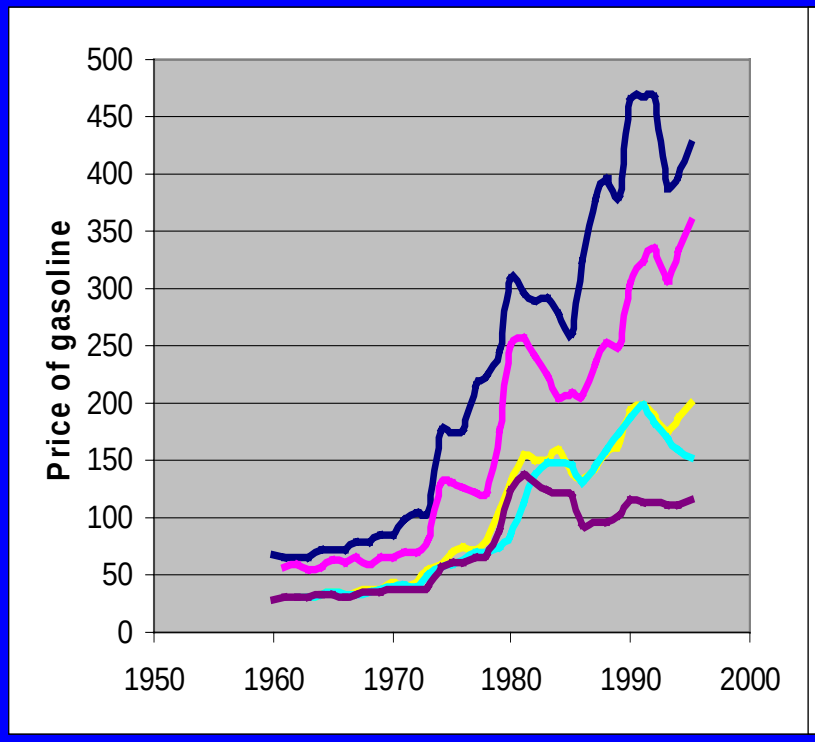
30 Years ago we worried about oil reserves. But the Market Mechanism solves this kind of problem: Makes depletable resources last for ever (?)

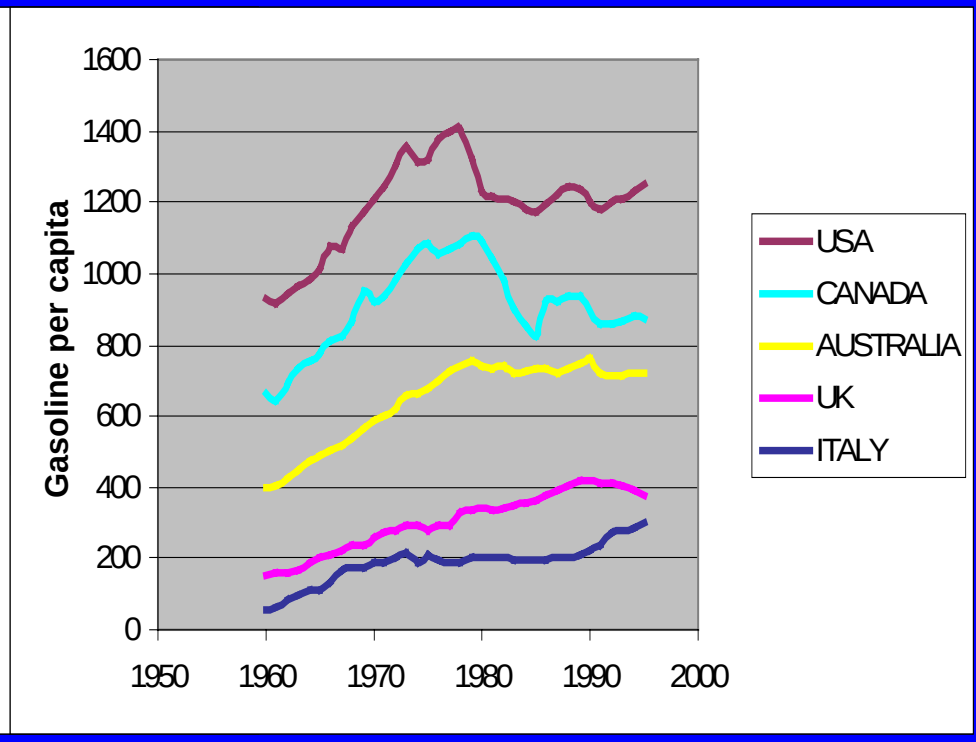


Growth and Environment !

- Can we increase income 50% and still reduce fossil carbon emissions by 50% ?
- Take the transport sector: A simple modell for fuel demand is $Q = Y^a P^b$
- Elasticities 1 for income Y, –0.8 for price P

Gasoline: Price & Use/cap





Simple-minded economist solves major problem:

- All you need is to raise price of fuel by 300% !

- Because $P = (0.5/1.5)^{-1/0.8} = 3.95$

300% !

- Is that **realistic**??
- What happens to Welfare?
-
- Isn’t there some **other way** ?
-

- Is it **possible**?

Is that POSSIBLE?

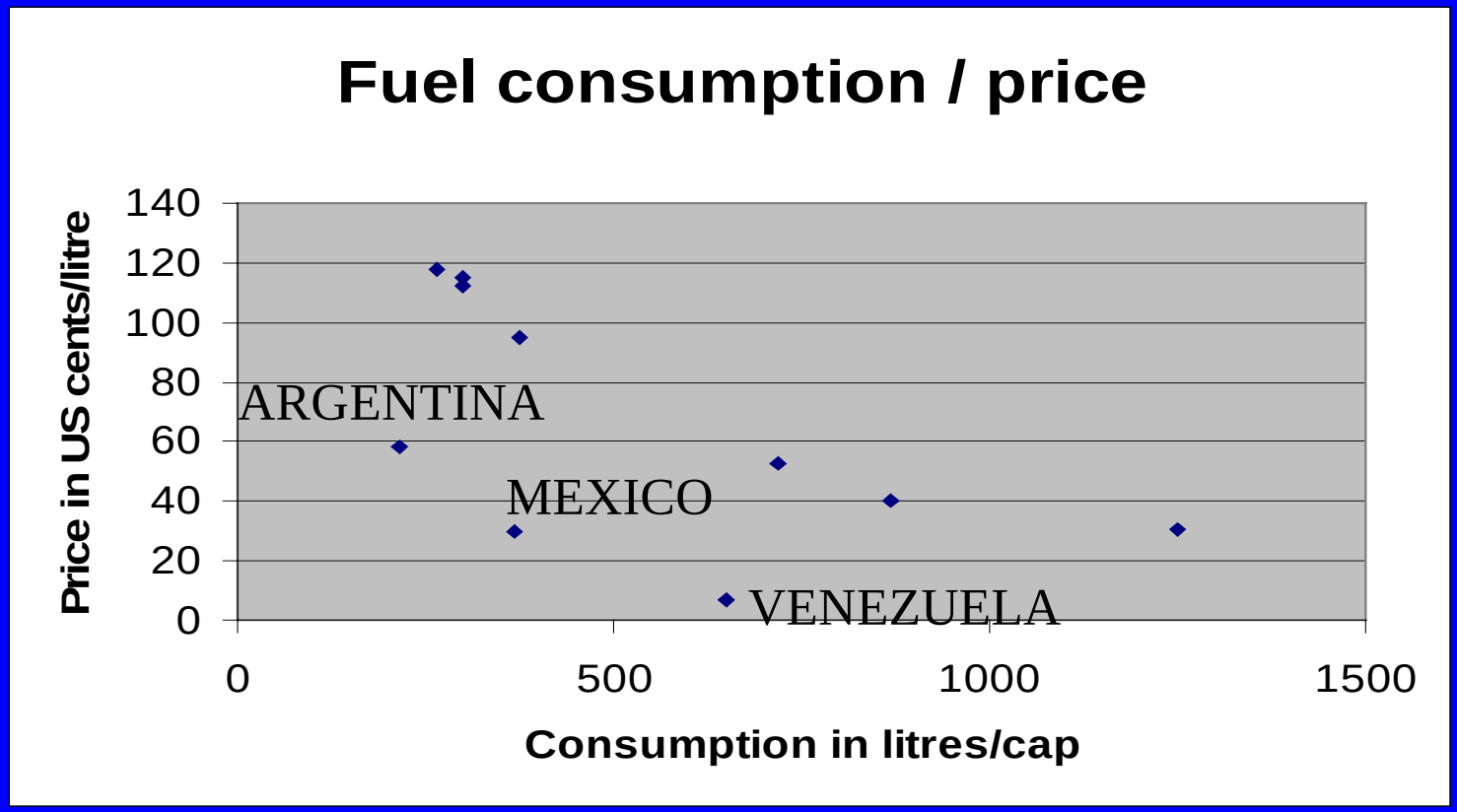
- Yes
- Most of Europe has already carried out most of this increase! The international price of fuel is 0,3 $/l. What's the price here?
- If the Whole World had prices like in the UK or Italy a large share of the problem would be solved.
- Though only for transport. We haven't done much concerning industry and electricity yet…

Some solutions

- 0 energy houses – even in Sweden
- Biofuel in Swedish district heating
- Carbon sequestration and burial in Norway
- 0-carbon emission technology in electricity
- Energy efficiency still number one…

Transport management (Global)

- Taxes & Fuel demand very high in low-price countries of Third World

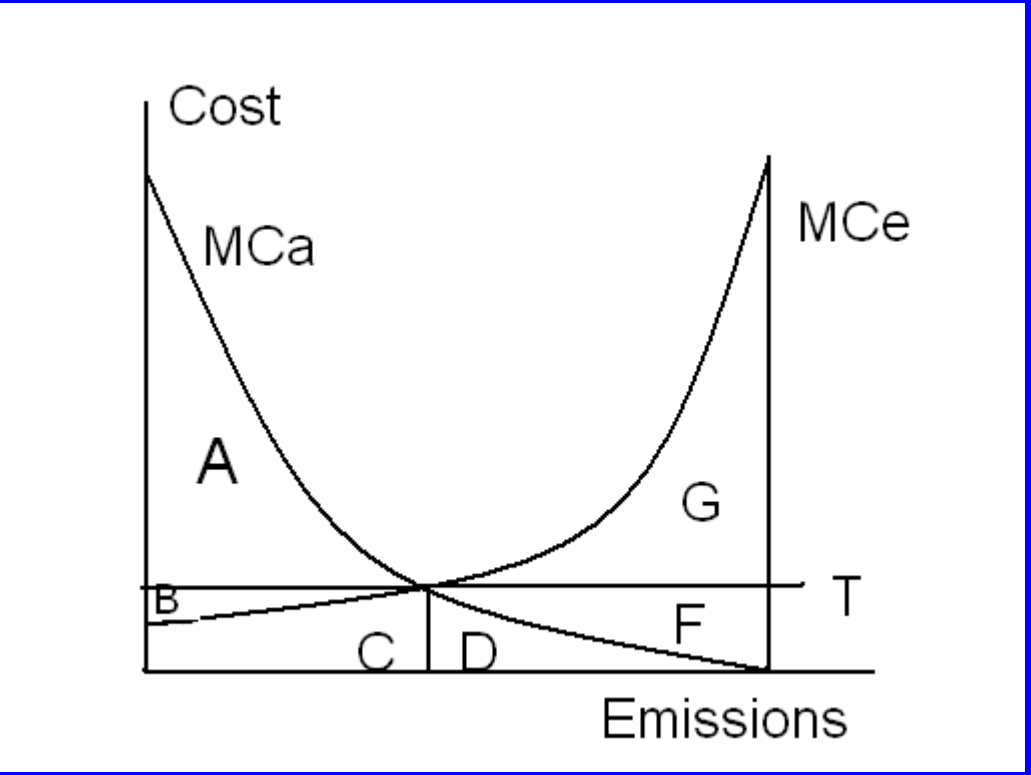


Estimates of environmental costs

- 1988 car:
- 12 €/1000 km in the country-side but over 130€ in city centre
- 2010 car had figures of 0,3 and 4 respectively.

- Car turnover important
- Get worst cars out of city centres
- Differentiated envir. Congestion pricing
- I&M
- Cut smog – reporting
- Parking?? and others

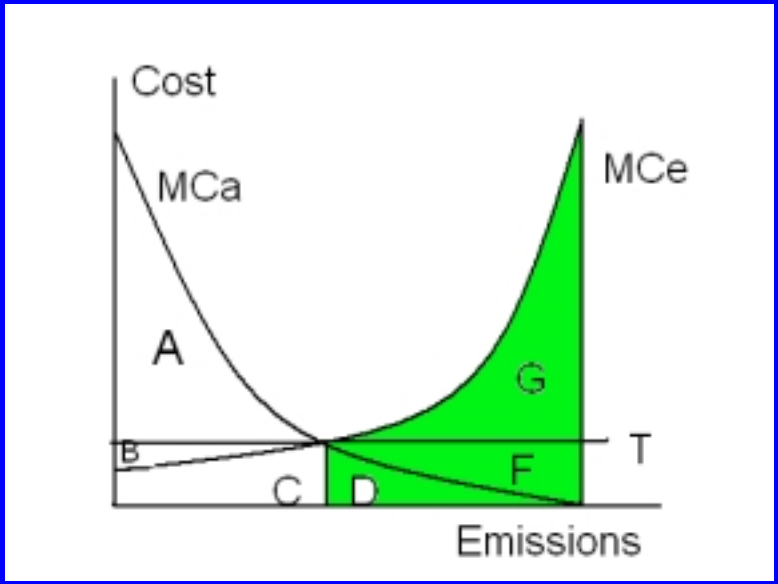
The Distribution of Costs

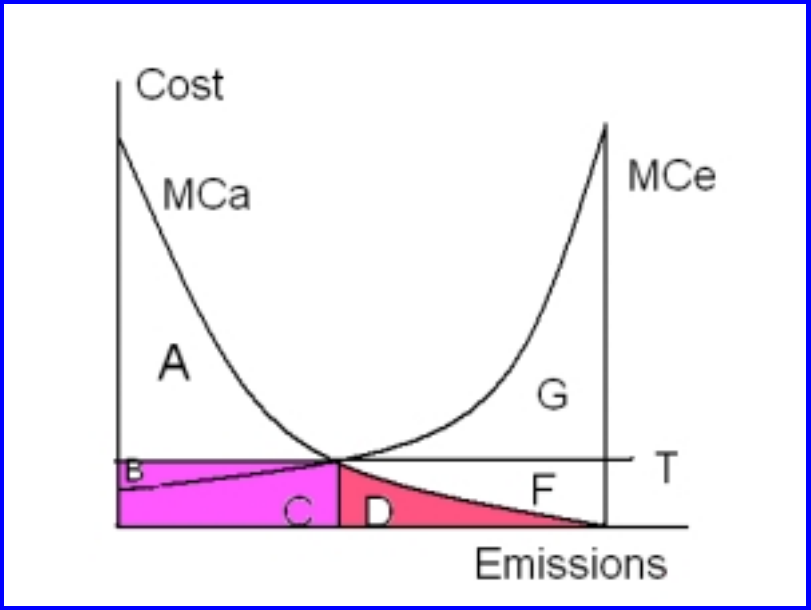


The Distribution of Costs

- Environmental benefits are D+F+G

- Abatement costs D
- Tax imply extra cost
- of B+C





	Ownership rights to the environment				
	Polluter (absolute)		*Polluter (relative)*	*Mixed*	*Victim (PPP)*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Burden of costs					
Environm BENEFIT	D + F + G		D + F + G		
Polluter costs	**F**	**0**	**-D**	**-C-D**	-B-C-D
Society	**-D-F**	**-D**	**0**	**C**	**B+C**

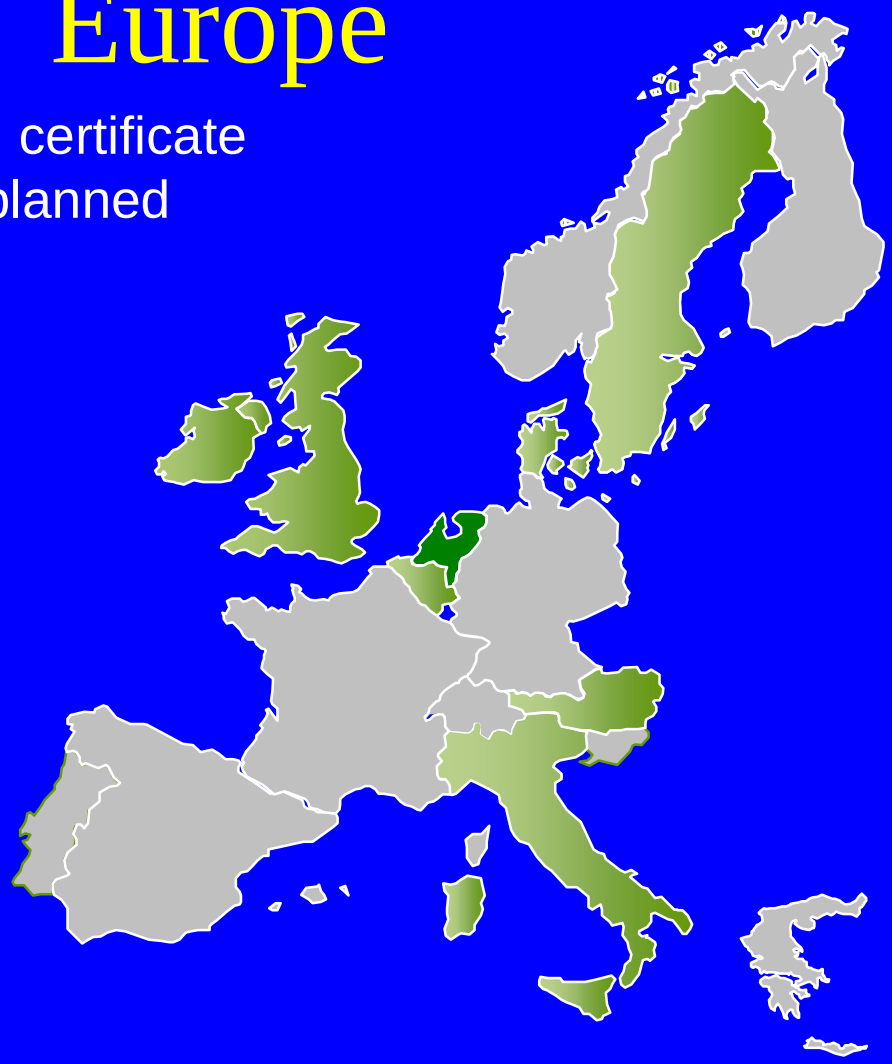
	***Ownership** rights to the environment*				
	Polluter (absolute)		*Polluter relative)*	***Mixed***	*PPP*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Type of instrument					
Q-type	Public cleanup		CAC VA free TEP	Hybrid	TEP auction
Mixed			Hybrid	Hybrid	Hybrid
P-type	Subsidies		REP Tax-subsidy	Partly REP	Tax DRS

Political aspects

- Lobbying, Monopoly and market power
- The importance of PROCESS
- ***"Que tout vieil impôt est bon***
- Swedish Local Investment Funds
- Psychology of incentives crowding out moral
- Monitoring and the Harrington Paradox
- Corruption & Informal sector
- Building institutions such as EPA
- International Aspects: Transboundary , Trade,

Green certificate schemes in Europe

Governmental green certificate scheme in place or planned



The Swedish electricity certificate system

- Postponed until 1st of May 2003
- Issuing starts in late June 2003

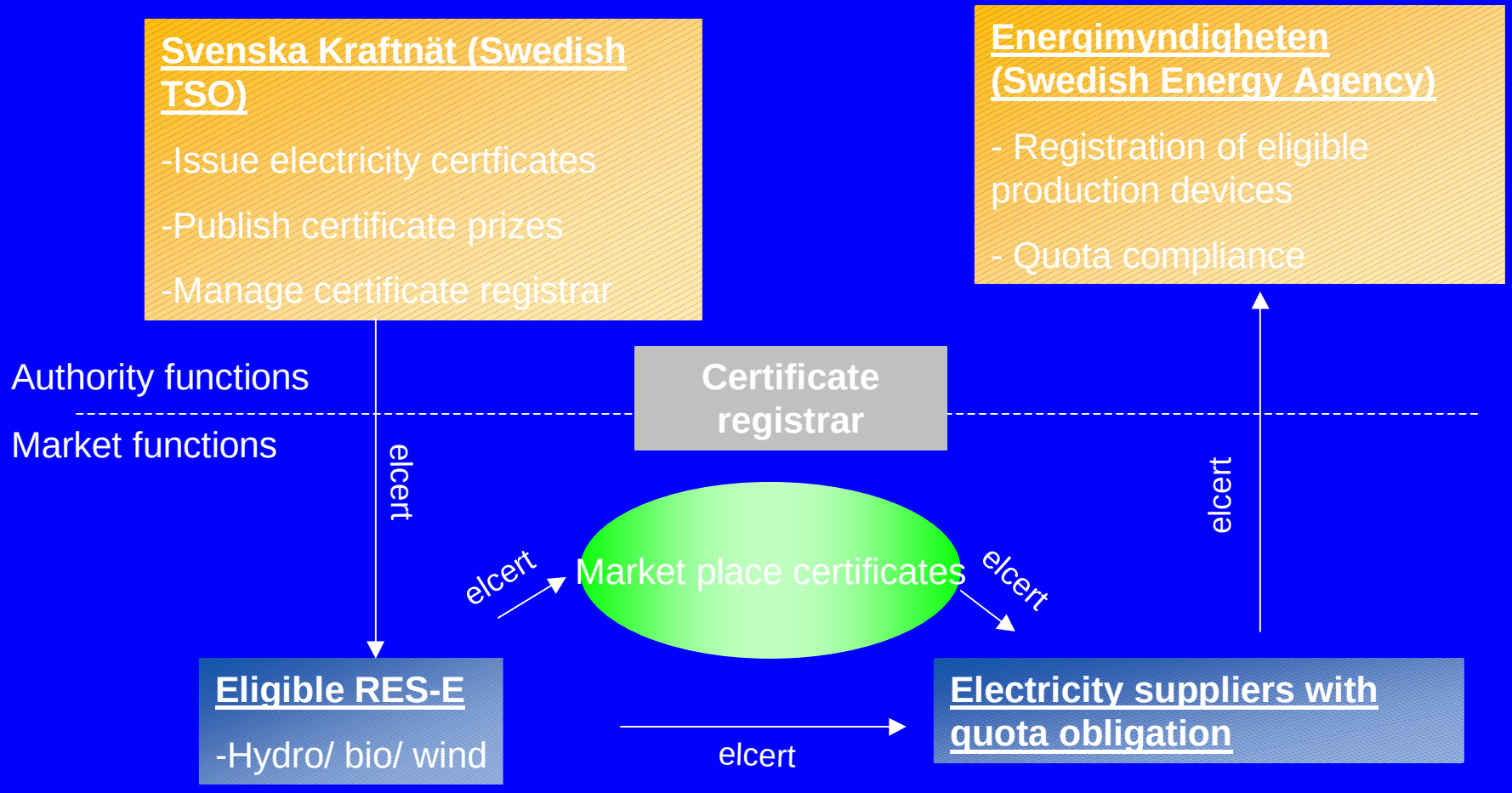
Purpose of the Swedish certificate system

- Stimulate new construction of electricity production facilities based on re-newable energy (RES-E)
- Stimulate development => create competition between different technologies
- Stimulate cost efficiency => market based instead of fed-in subsidies
- Reasonable conditions for existing plants
- Avoid effects on the electricity market
- Replace subsidies and offer stable long-term

The Swedish certificate system in short

- **Goal** to support new construction of RES-E, 10 TWh 2003-2010
- **Quota based certificate system**
- **Rights** for RES-E producers to receive/issue certificates per MWh el - from wind, hydro and biomass plants.
- **Obligation** for end-use customers/suppliers to show certificates
  - 2003: 6,7 % of the electricity purchase
  - 2010: 16 % of electricity purchase => additional 10 TWh
  - Electricity intensive industry, quota = 0 in the beginning

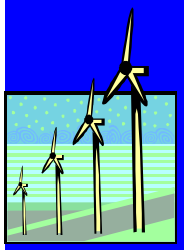
Organisation of the market



Eligible RES-E production

- **<u>General certificate scheme</u>: 1 MWh = 1 certificate**

- **Biofuel based power**
  - Wood chips, forest residues, black liquor, etc. Probably not peat.
- **Hydropower**
  - <1,5 MW
  - All new hydropower (after 1 July 2002)
  - Increased efficiency in existing power plants
  - Restart of power plants that were shut down before 1st of July 2001
- **Wind**
  - Certificates plus a feed-in tariff the first five years



Sterner Environmental Policy Making

Sterner Environmental Policy Making

Sterner Environmental Policy Making

Properties of Permits

- $L = pq_i - c_i(q_i, a_i) + P_e(\hat{e}_{i0} - e_i(q_i, a_i))$
- Kuhn-Tucker conditions are:
- $c'_a = -P_e e'_a$ MC Abatement is optimal
- $P = c'_q + P_e e'_q$ Output price is optimal
- If number of permits is related to output then second condition does not hold

Weitzman P vs Q

If there is uncertainty concerning the marginal cost of abatement and

- The Marginal Damage of pollution is very steep (thresholds)→**USE QUANTITY-type** instrument.
- The Marginal costs are thought to be steeper (for instance due to risk of bankrupcy) while damage is flat (eg stock pollutants) then **USE PRICE-type** instruments.

Some other rules of Instrument selection and design 2

- For some persistent pollutants (often related to energy/transport) tax revenues might be substantial. In this case the revenue-recycling effect of the tax implies other taxes can be lowered which decreases the cost of the instrument. This effect is lost if regulation or (free) permits are used.

Some other rules of Instrument selection and design 3

- Subsidies work ***roughly*** like taxes
- But have perverse output effect → encourage entry (delay exit from) industry
- Reduction of Perverse subsidies important
- Deposit Refund schemes superior to taxes when monitoring of pollution is expensive
- Fines or liability also important complement

Sterner Environmental Policy Making

REP (technical aspects)

- Each company maximizes profit
- $Pq_i - c_i(q_i, a_i) - Te_i(q_i, a_i) + q_i/(\Sigma_i q_i)T[\Sigma_i e_i(q_i, a_i)]$
- q is output, c is production costs, a is abatement, and Te_i is the charge $q_i/(\Sigma_i q_i)T[\Sigma_i e_i(q_i, a_i)$ the refund. FOC are
- $P = c'_q + Te'_q(1 - \sigma_i) - T(E/Q)(1 - \sigma_i)$
- $c'_a = -Te'_a(1 - \sigma_i)$

Sterner Environmental Policy Making