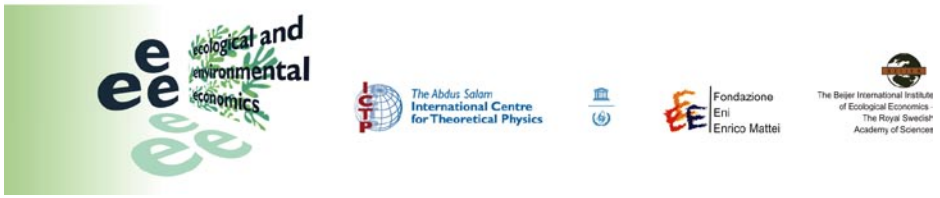


1st Teaching Workshop on Environmental Economics

for the Middle East and North Africa

December 5-16, 2005 - ICTP, Trieste, Italy

Policy Instruments 2
Some Applications

Thomas Sterner

University of Gothenburg

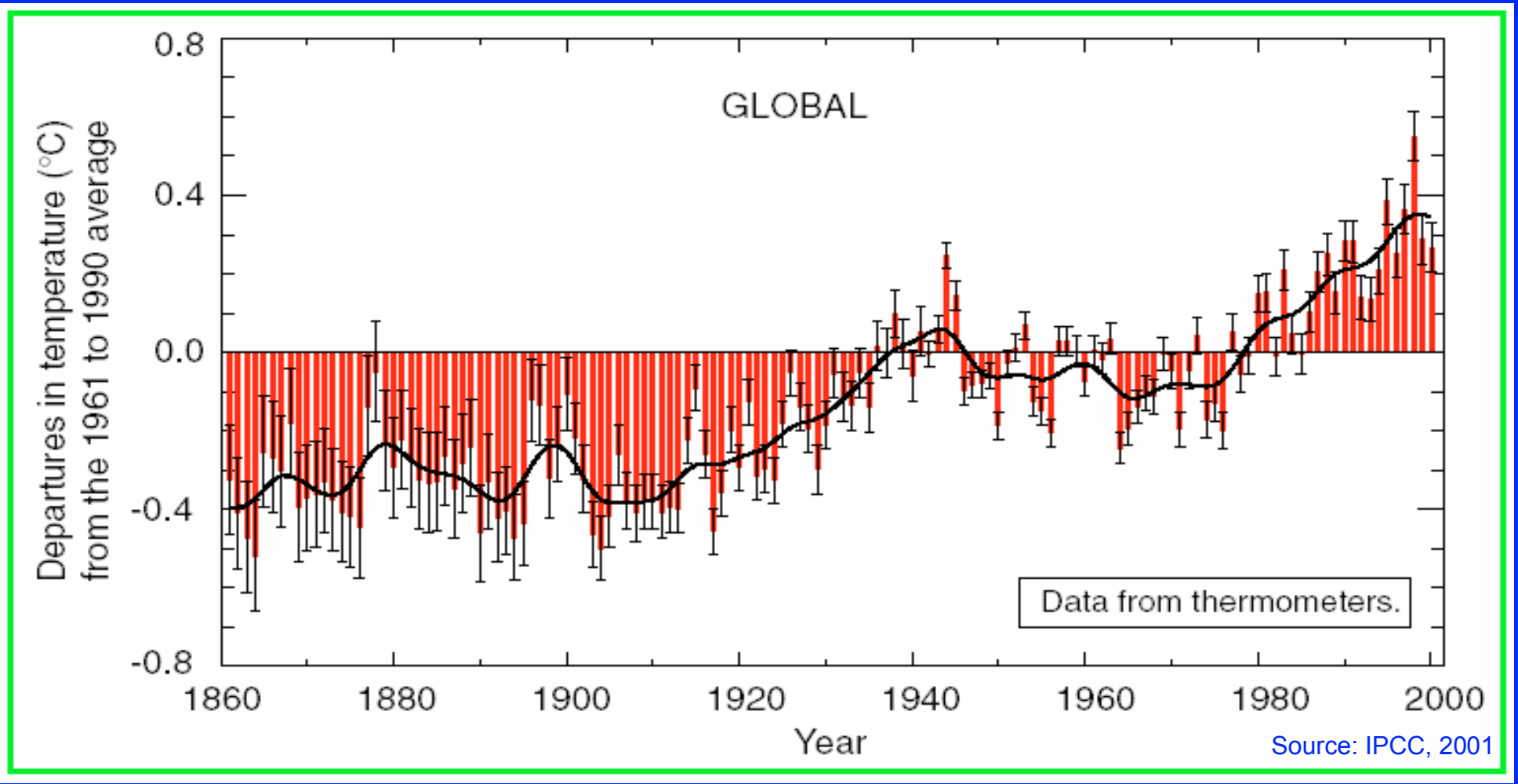
SMR 1684 - 6

First Teaching Workshop for Middle East + N Africa ICTP Dec 2005

Policy Instruments 2
Some Applications

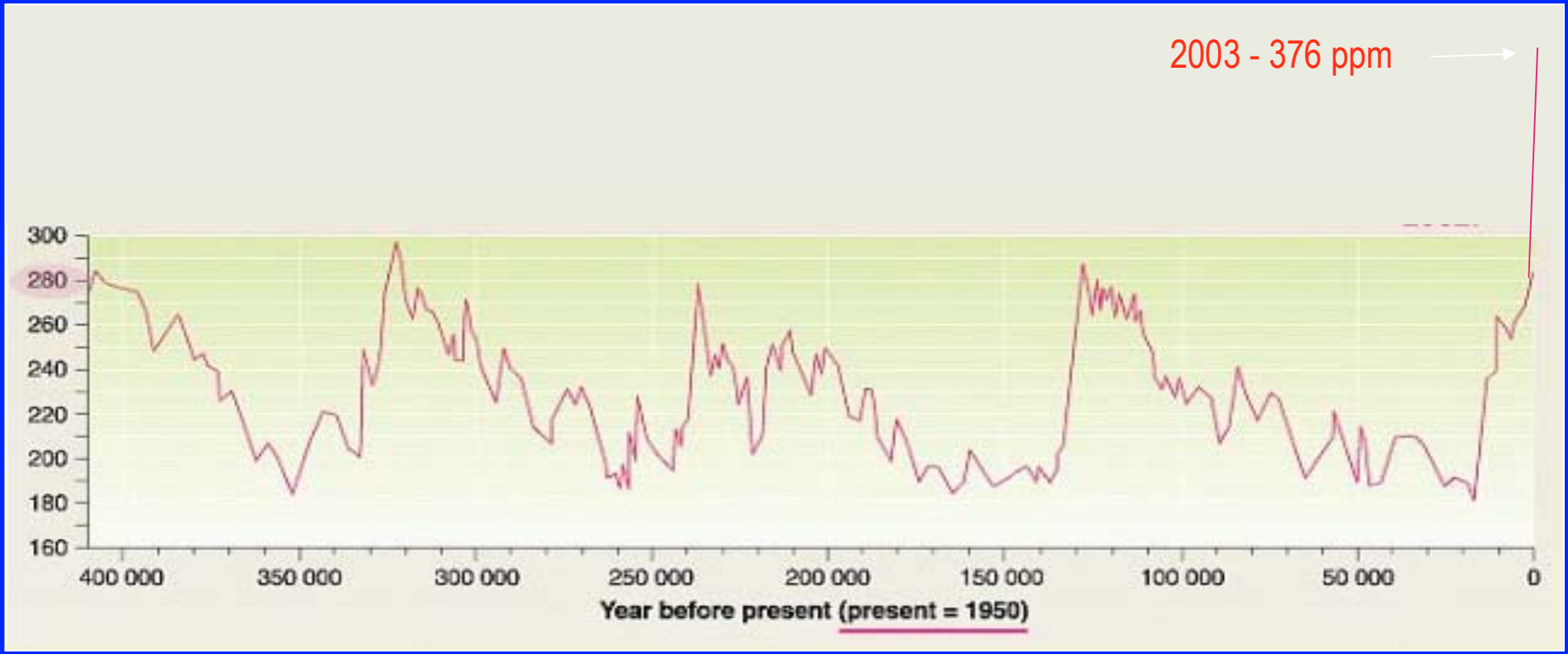
Thomas Sterner

Global mean temperature 1860 - 2000

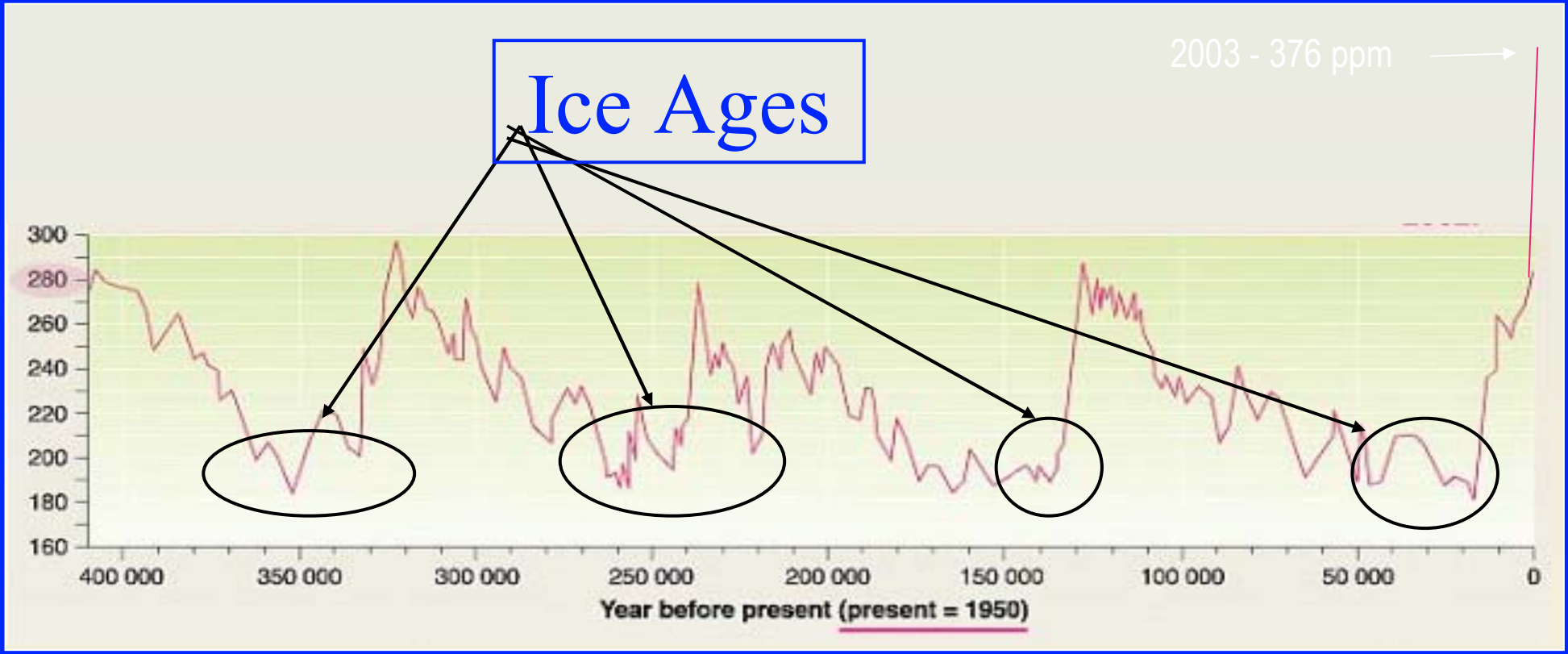


Thanks to Christian Azar and Martin Persson for slides

Historical variation of atmospheric CO_2-concentration



Look carefully: you won't find time scales like this in economics…



This is the period of time we usually call ”History”

Radical goals for the future ?

800

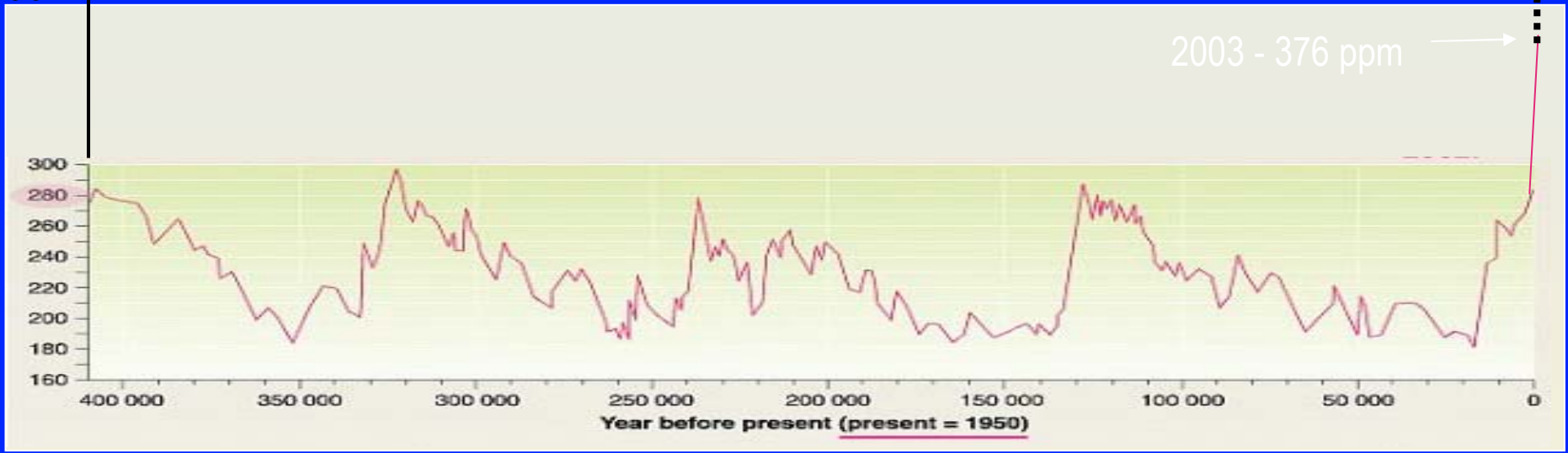
700

600

500

400

EU goal (?)



800

700

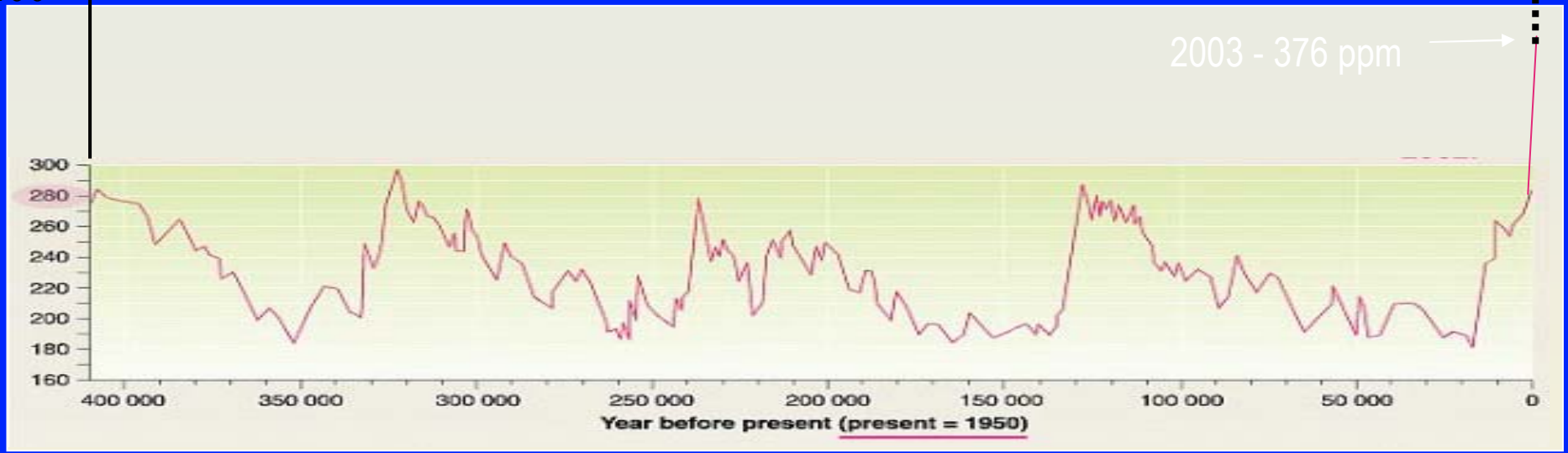
600

500

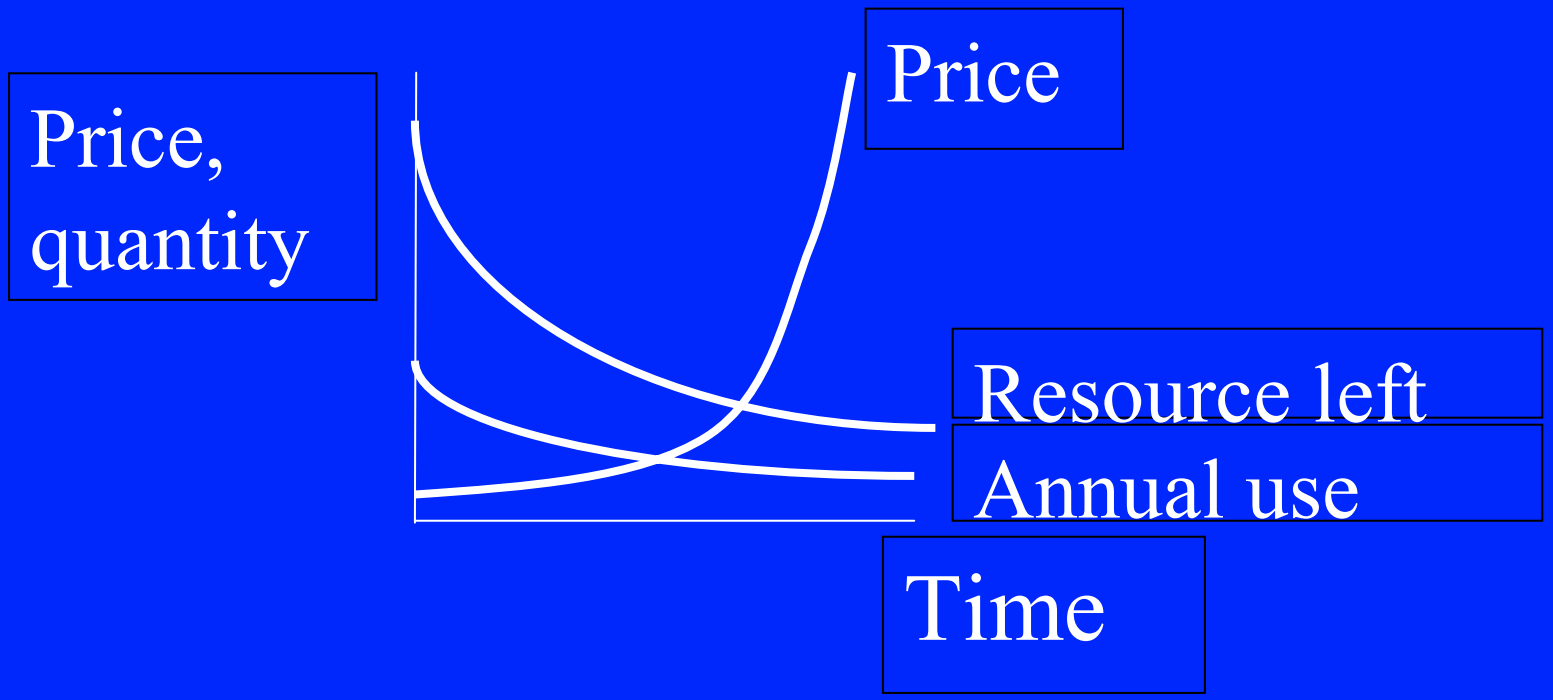
400

Bush goal (?)

EU goal



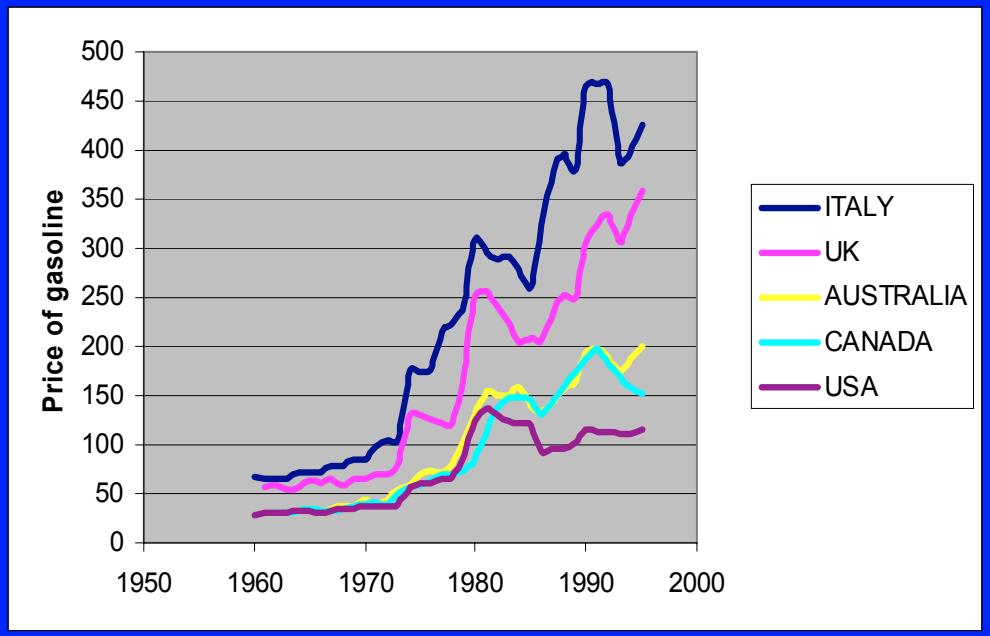
Market mechanism

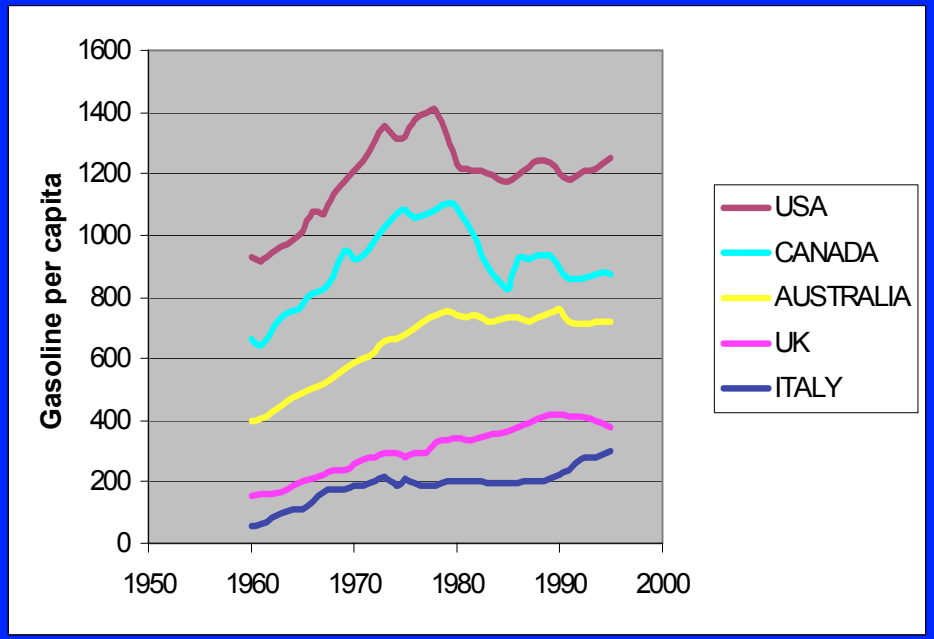


Growth and Environment !

- Can we increase income 50% & reduce fossil emissions 50% ?
- Transport sector:
- Fuel demand $Q = Y^a P^b$
- Elast: Income: 1, Price –0.8

Gasoline: Price & Use/cap





HOW DO WE …

- Increase income 50%
- Reduce emissions 50%
- Transport: $Q = Y\ P^{-0.8}$

economist solution

- Raise fuelprice 300% !
- Because
- $P = (0.5/1.5)^{-1/0.8} = 3.95$

300% !

- **Realistic**??
- Welfare?
- Isn’t there some other way?

Is it possible?

Yes …

- Europe has done it!
- If all countries had european fuel prices a large part of the problem would be solved
- + Industry, heating & elect…

Fuel taxes potent instruments for Climate policy

- With UK prices OECD -40%
- With **US** prices +40%
- Gas tax more important than Kyoto
- why not tax more?
- **harder to raise US tax than UK?**
- Political lobbies decide

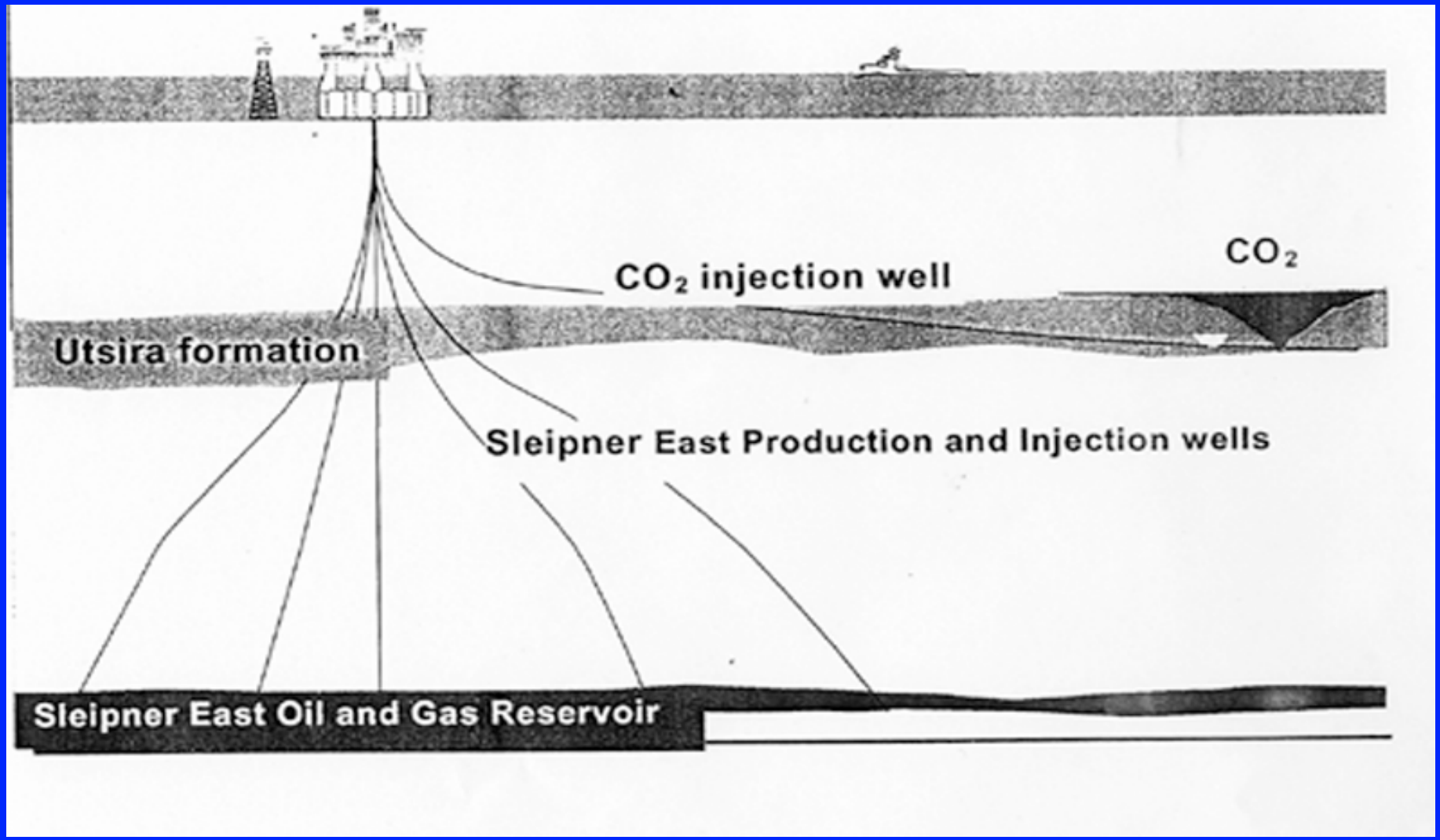
Effect of higher fuel price

Country	Price	Fuel use	Hypothetical fuel use	Reduction in %
AUSTRAL	0,54	13306	7664	42
CANADA	0,51	28167	15535	45
FRANCE	0,95	14216	12968	9
GERM	0,85	30025	25061	17
ITALY	1,12	17565	18230	-4
JAPAN	0,61	41828	26742	36
MEXICO	0,69	21343	15025	30
NETHERL	1,07	4139	4147	0
SPAIN	0,92	8928	7919	11
UK	1,07	21513	21504	0
USA	0,31	356981	131819	63
OECD	0,53	605873	346844	44

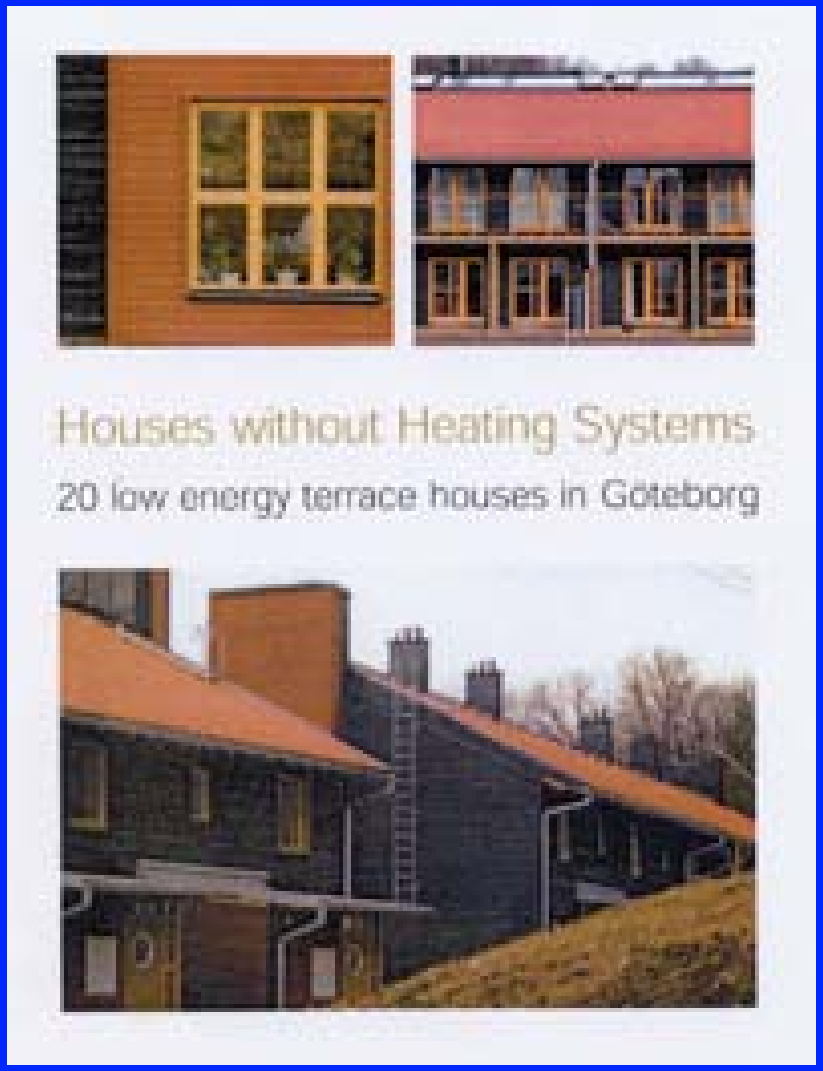
Climate change Soloutions

- WHAT CAN WE DO?
- Many *different* things

CO2 storage

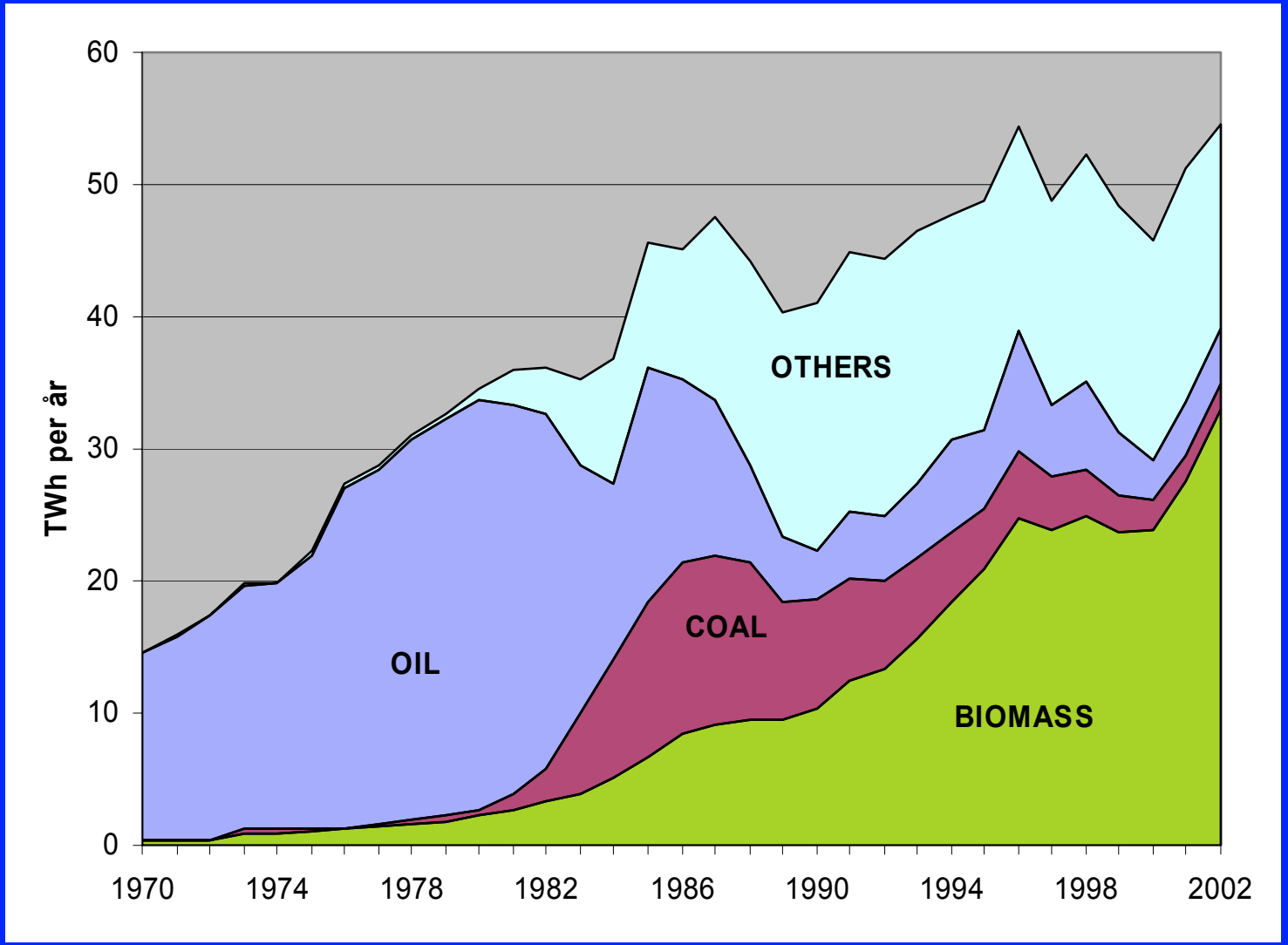

CO_2 injection well
CO_2
Utsira formation
Sleipner East Production and Injection wells
Sleipner East Oil and Gas Reservoir

Houses with no heating



In Sweden !?

Fuel use in Swedish district heating



WHY?

- CO2 tax

Some more Topics

- CONGESTION in transport
- --and in fishing
- TCE Prohibition, tax or BAT
- REP/ NOX
- Political-psychological aspects

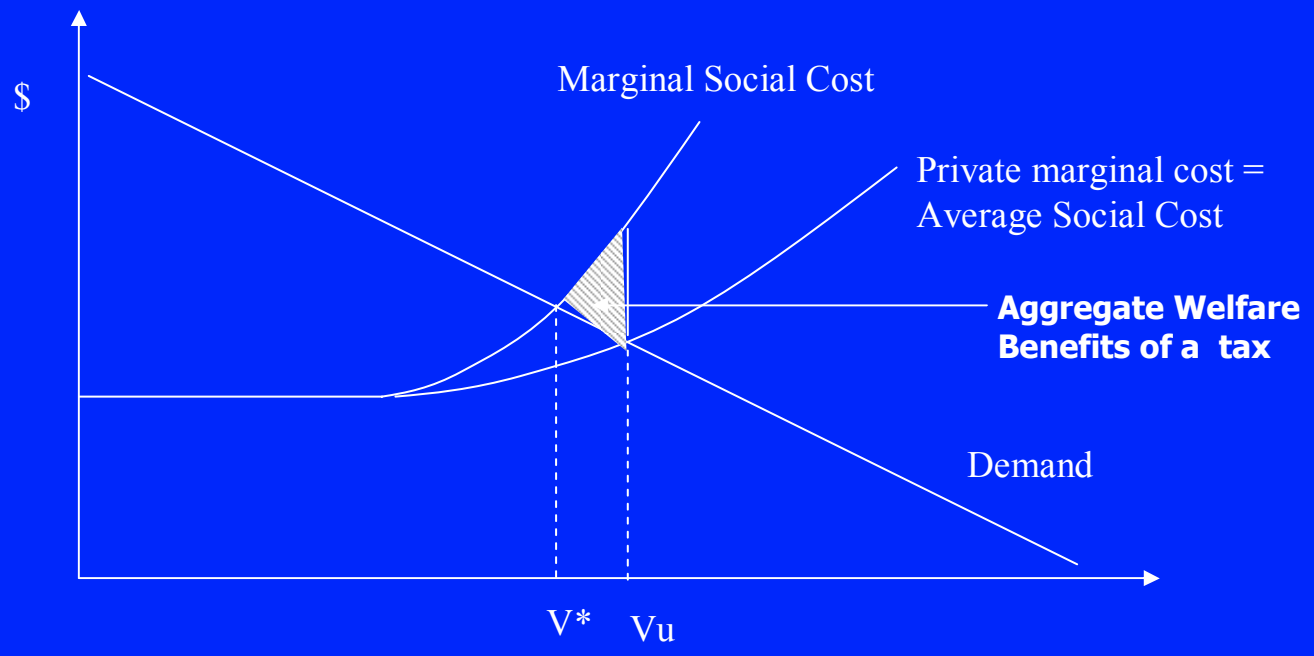
The Economics of Congestion

- Assume marginal cost for each vehicle increases with vehicle flow c(V)
- Total cost for traffic V $C(V) = V*c(V) + e(V)$
- Average private cost for V vehicles = $V*c(V)/V = c(V)$

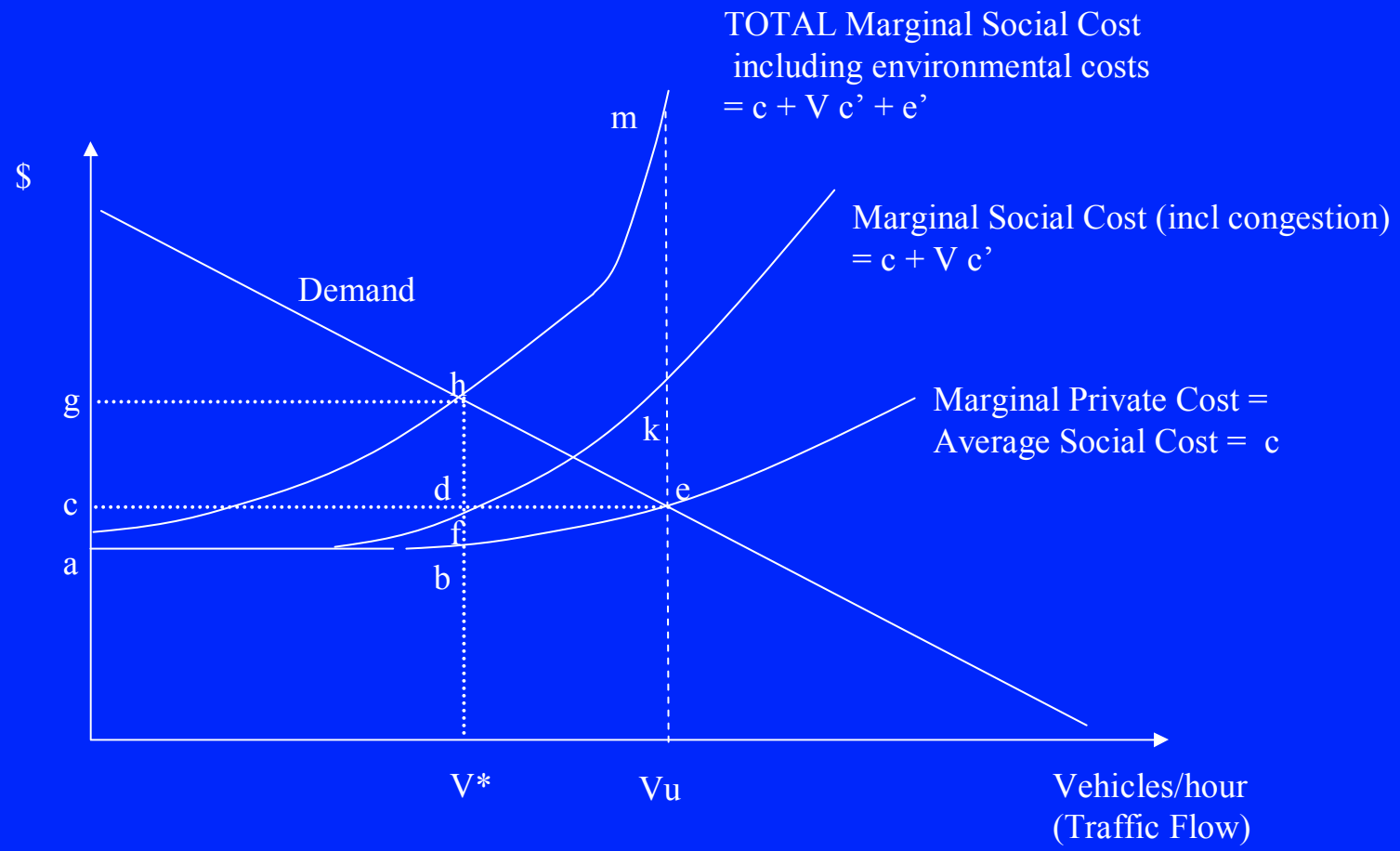
- Marginal social cost = $C' = c(V) + Vc' + e'$

NB that both c' and e' increase strongly with increasing flow V

The Economics of Congestion



Congestion and Pollution



Sterner Environmental Policy Making

The DISTRIBUTION of costs and benefits

- Benefit to society of regulation is avoided welfare loss ***hem*** but note DISTRIBUTION
- ***BENEFITS***:
- Victims of Pollution gain ***fkmh***
- State gains Tax revenue ***abhg***

- **COSTS**
- Motorists who continue driving gain time but pay tax ***abdc-abhg*** =
- ***Loss of -cdhg***
- Motorists who stop driving lose CS ***–beh***

Special Environmental Considerations

- Emissions depend very strongly on technology!

Vintage	VOC	Nox	Pm
1988	2,5	1,53	37
2000	0,46	0,17	7
2010	0,08	0,04	1,2

And other factors like temperature, population density

Temp	CO 1st Km	Warm engine	VOC 1st km	Warm engine
22	21	0,12	2,6	0,02
-7	123	0,8	15,7	0,25

All figures g/km

Estimates of environmental costs

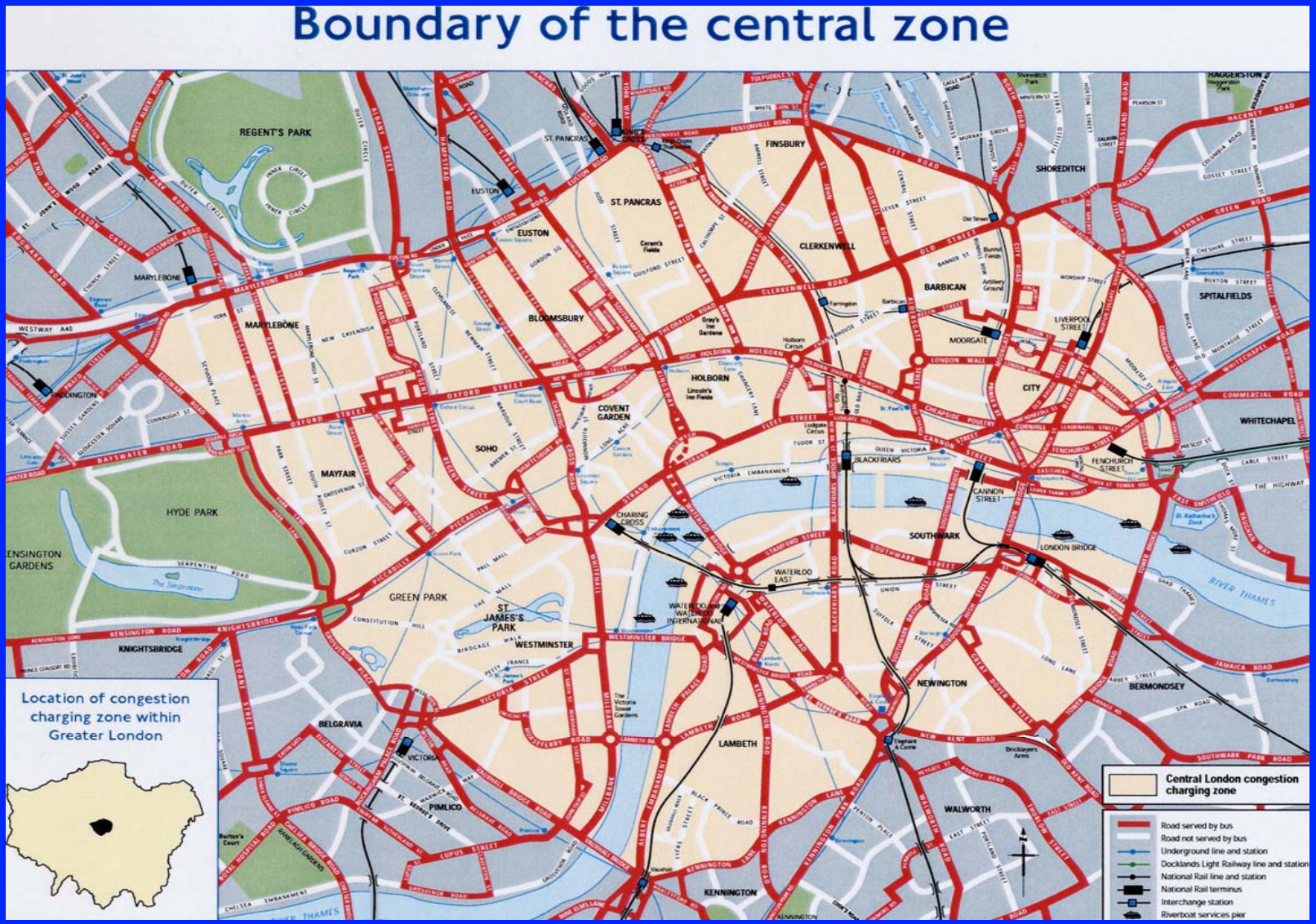
- 1988 car:
- 12 €/1000 km in the country-side but over 130€ in city centre
- 2010 car had figures of 0,3 and 4 respectively.

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

Transport management (local)

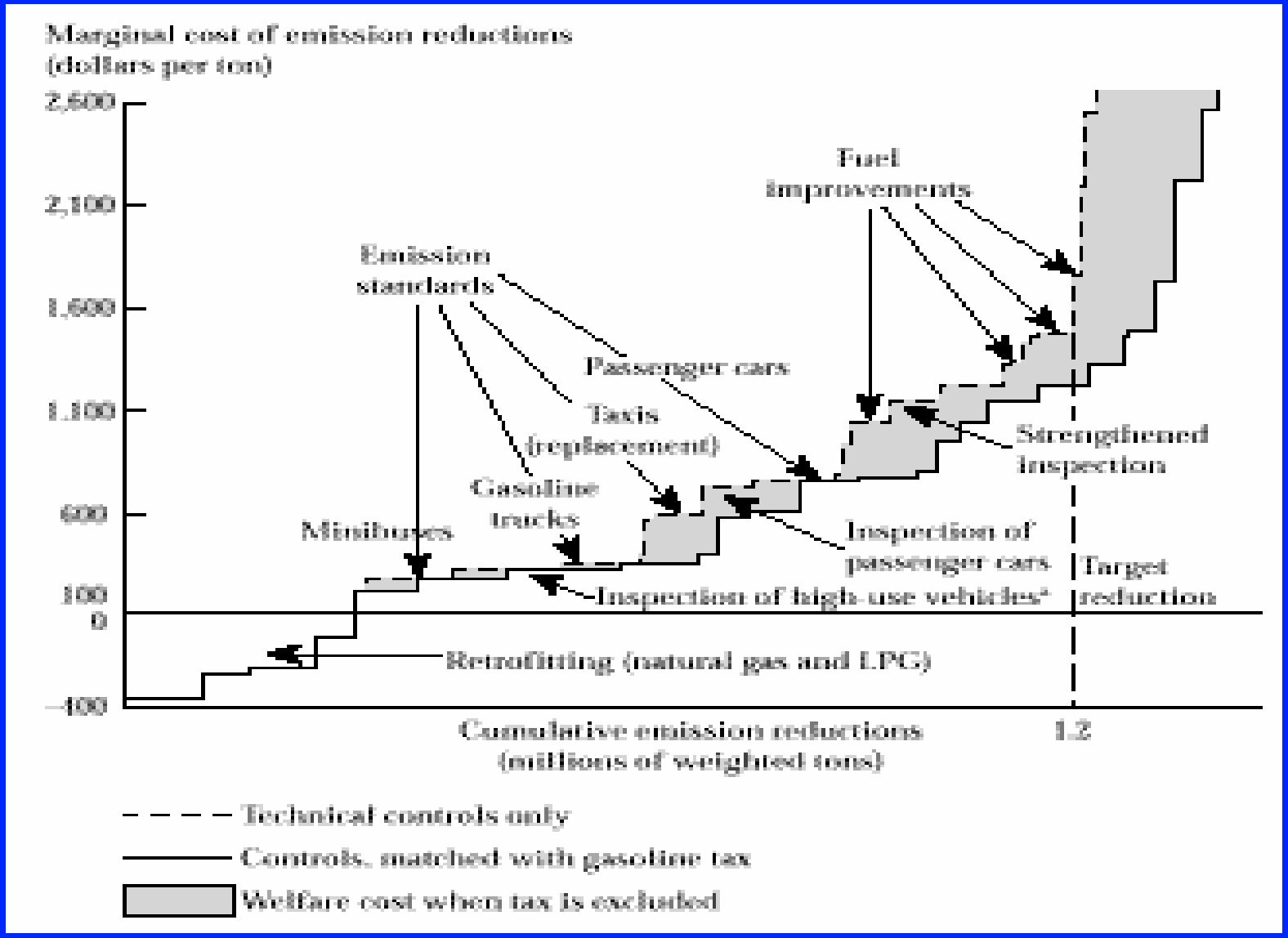
- Singapore Advanced Road Pricing
- Curitiba dedicated express buss lanes
- Banning of vehicles (Vikhram Tempo)
- Cleaner fuel: Phase-out of lead
- Green busses & taxis
- Dia sin Auto
- Roadside monitoring

London



Sterner Environmental Policy Making

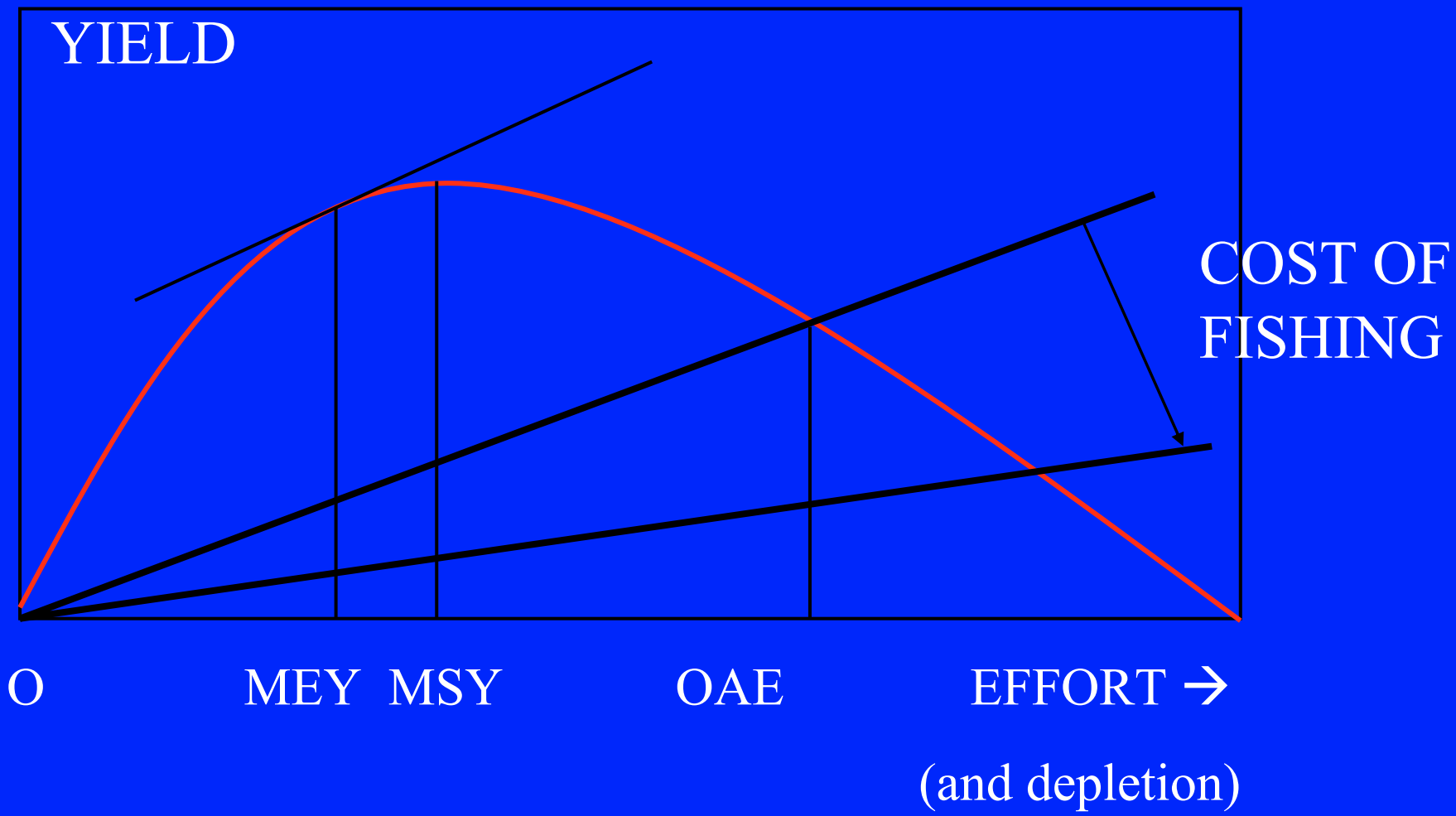
Transport in MegaCities



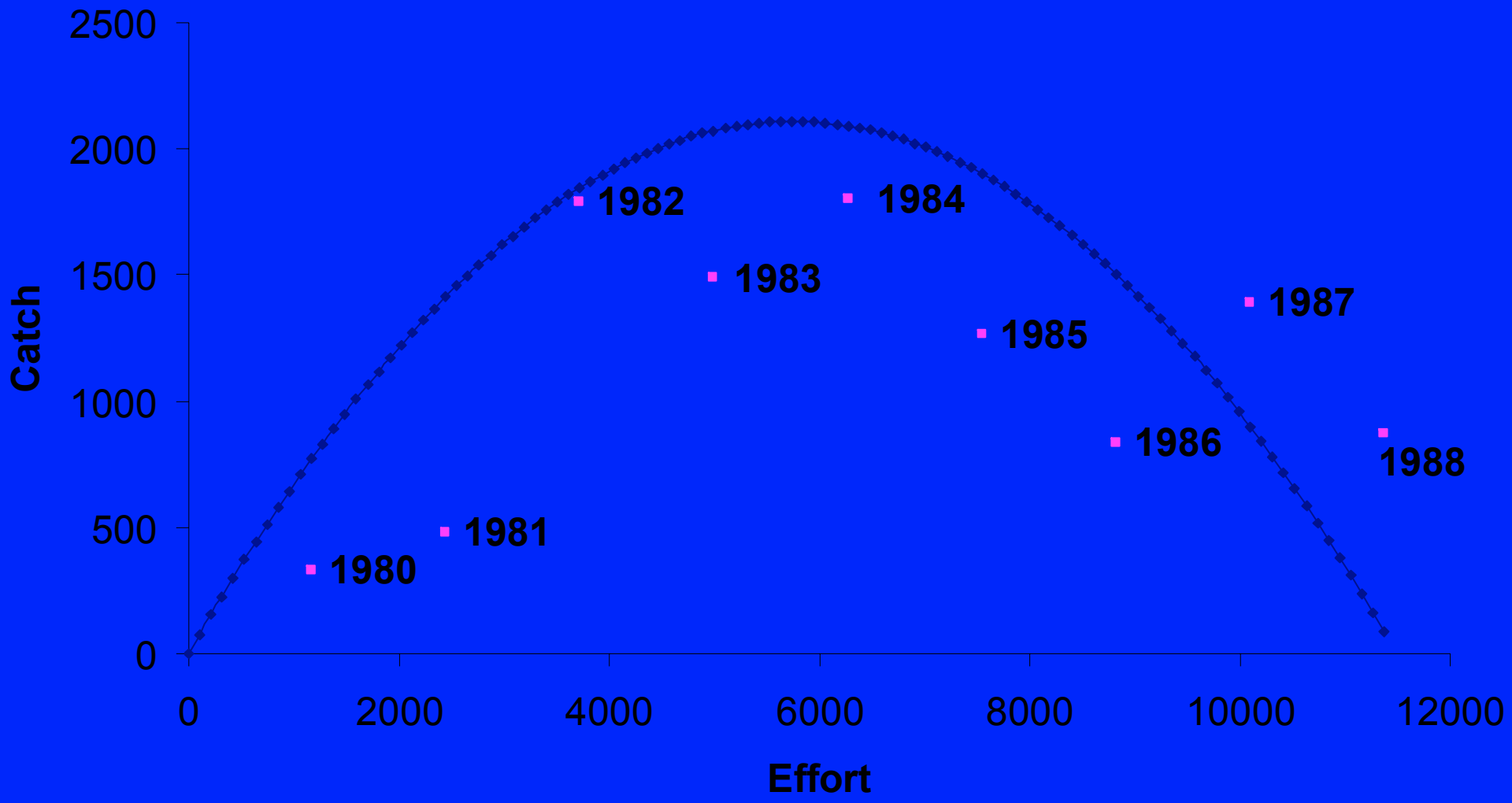
Fisheries

- Rather like congestion
- Fishermen would all be better off if effort brought down.
- However a tax that collects all the rent will actually make the fishermen worse off
- Fishery policy badly needed but typical policies are exact opposite of required!

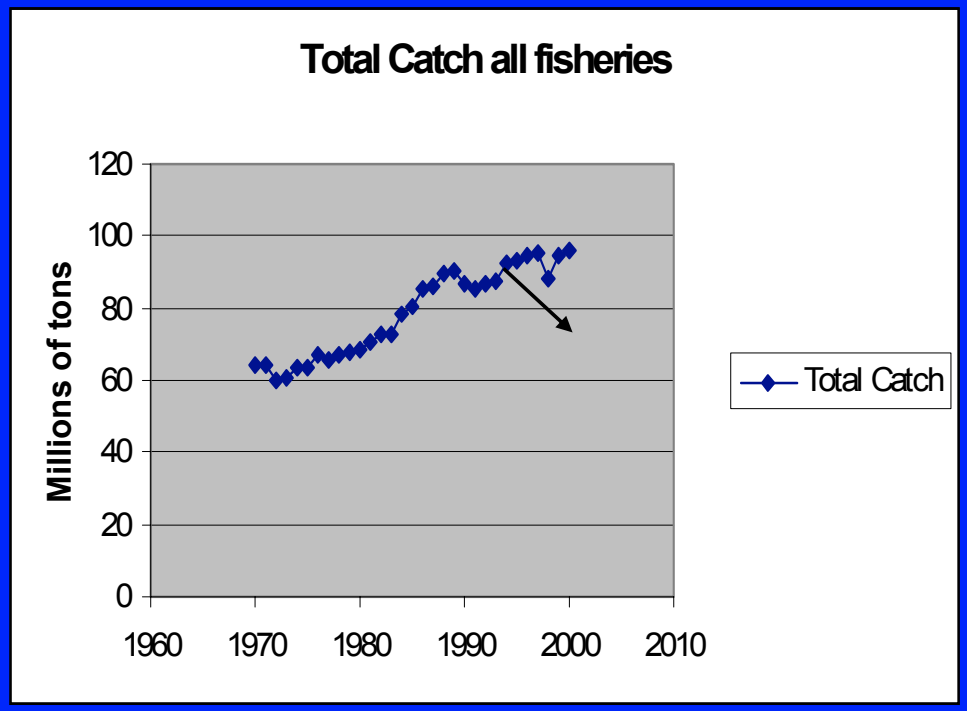
A Bio-economic model of fishing



Over-fishing on Zanzibar

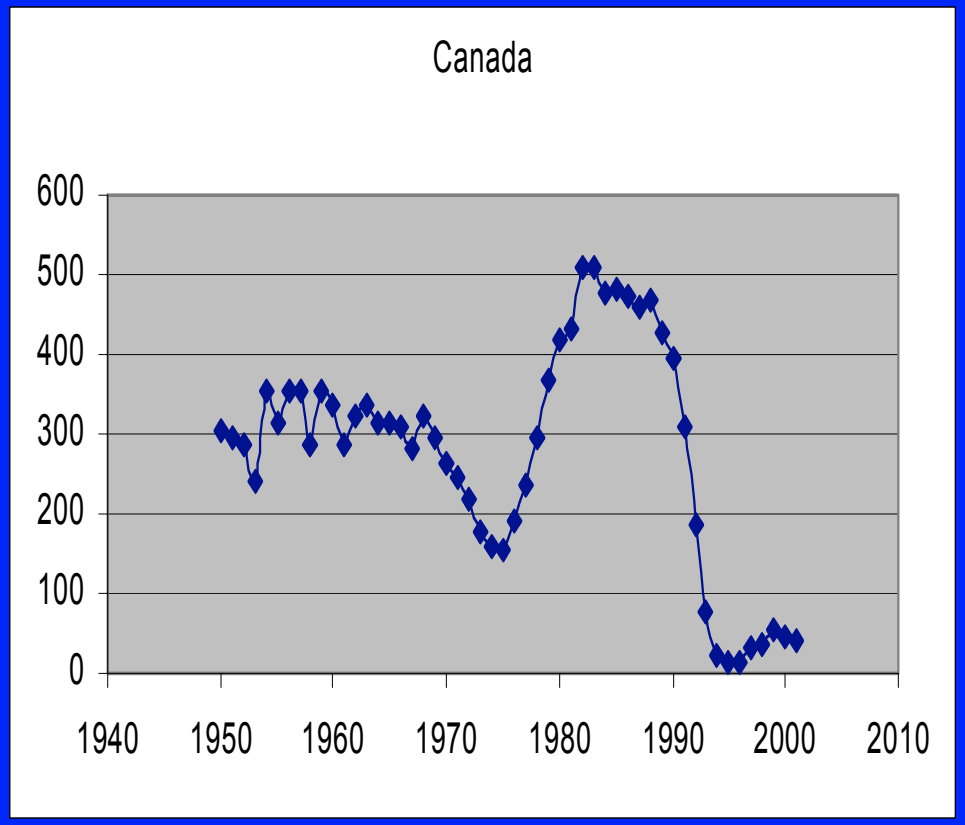


Fishy Policies



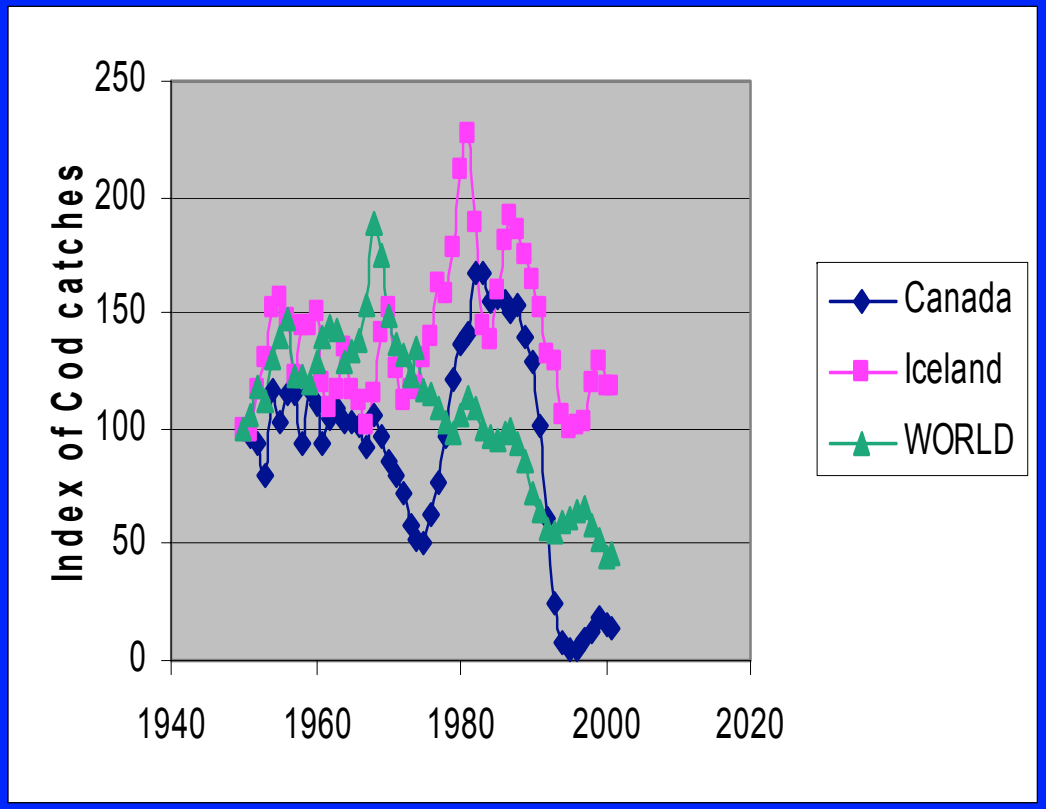
- Last natural frontier
- Severe over fishing due to open access
- POLICY NEEDED
- Actual policies opposite to ideal
- ITQs
- Zoning, CPRs

COD



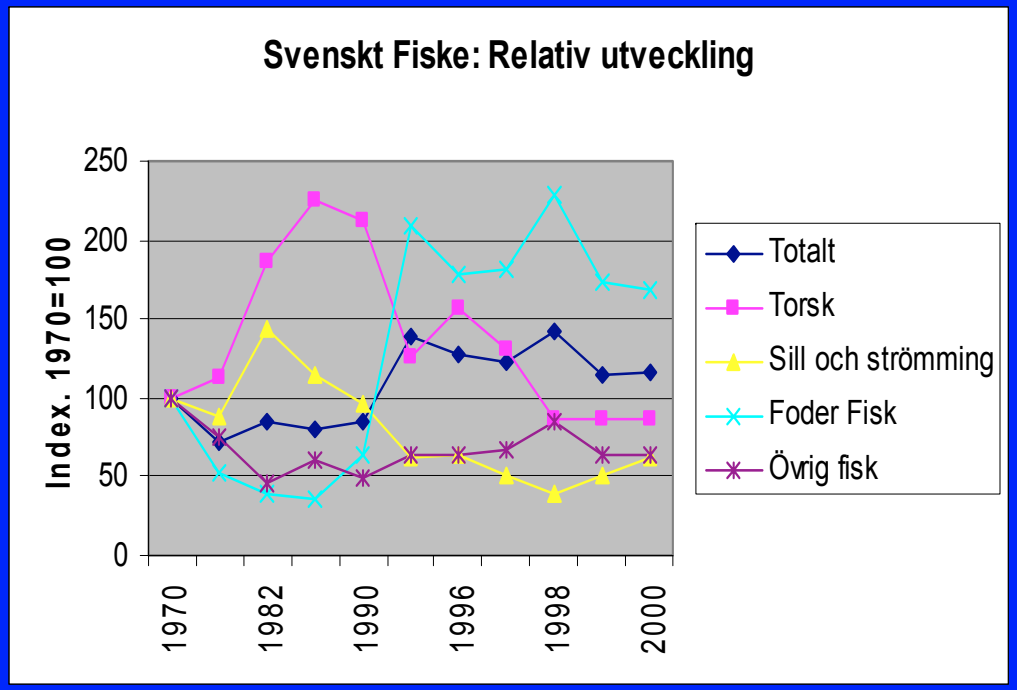
- Cod in Atlantic Banks outside Canada richest in the World
- Crashed 1992
- 30 000 fishermen unemployed
- No sign of recovery after 10 years!

Iceland shows the way



- World Cod catch down 75% since 1968
- 200 mile EFZ hopeful
- Private transferable quotas as SHAREs in TAC
- TAC decided by biologists

Sweden



- Lost North Sea
- Fleet not scraped nor sold to Denmark. Fishes in Baltic
- Coastal cod extinct
- North sea cod severly overfished
- EU sets agenda

CPR or Tragedy of open access

- Property rights are crucial for management
- When yields are low/erratic →CPR
- Can work well for irrigation, pasture, fish
- Clear boundaries; Exclusion; Democracy; Peer monitoring; 'Courts'; Graduated fines
- New forms: CAMPFIRE, NPSP farming or informal sector →AIE
- Eco tourism, park fees. Pay for eco-services

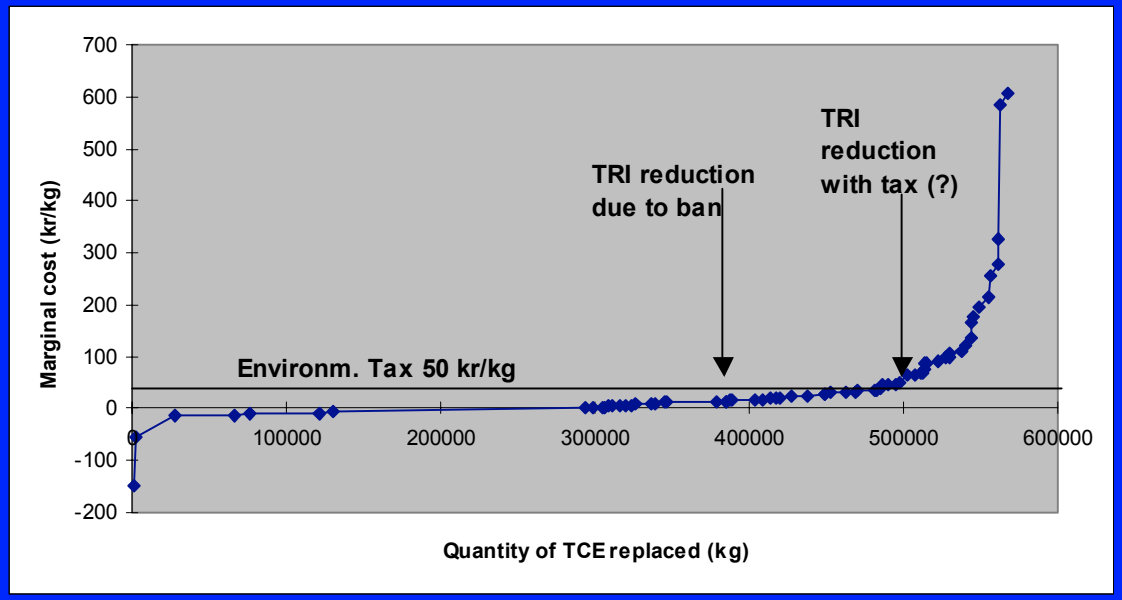
Industrial Pollution

- The Classical Domain of Environmental Economics
- Also relevant in many poor, industrialising countries
- Often starts with information and regulation
- Then moves to MBI, taxes/permits & Liability
- Prohibition not necessarily best!

Phase out of Trichloroethylene

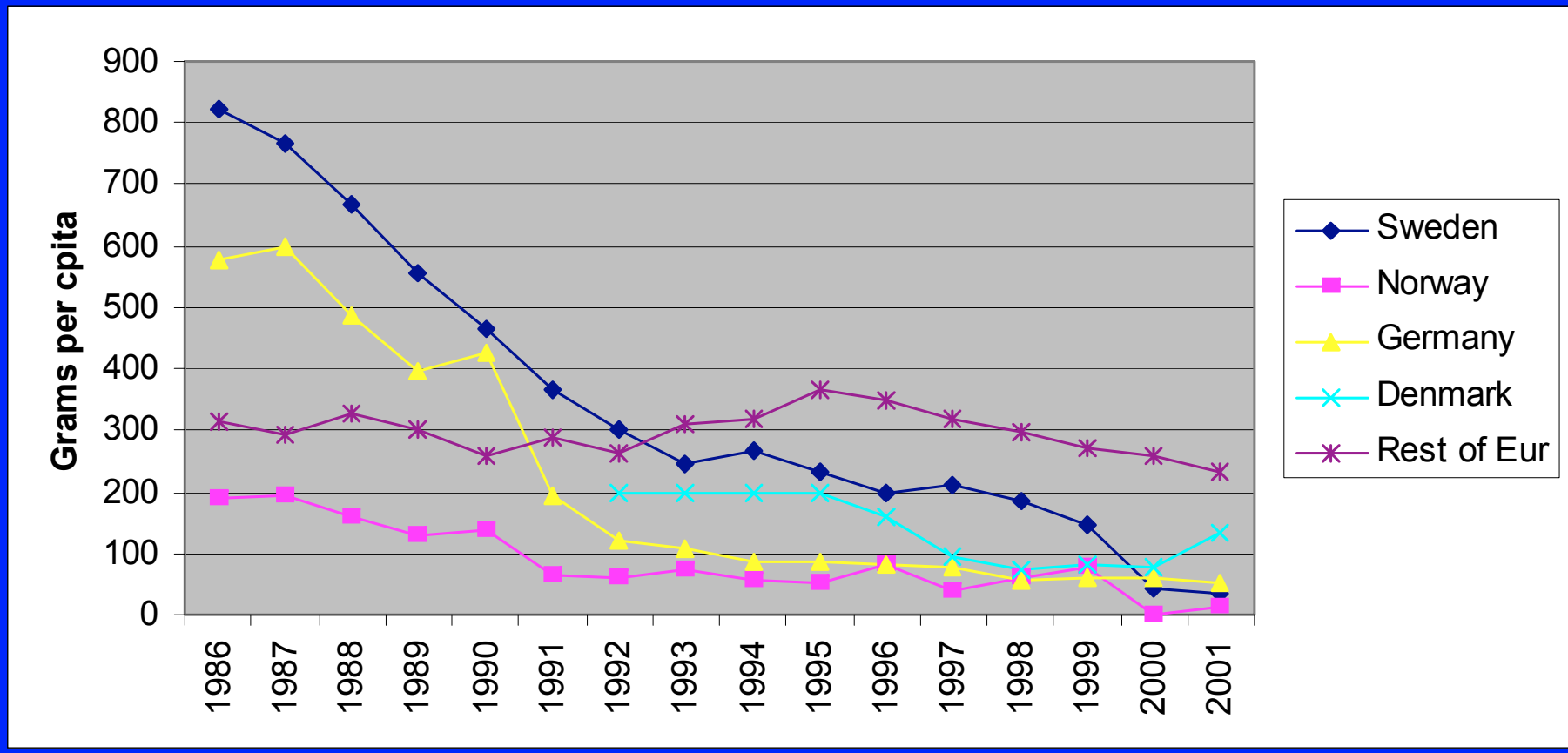
- (C_2HCl_3) Degreaser. Good Fat solvent…
- Big Working Environment hazard
- Phase out of CFCs lead to increased use
- Forbidden in Sweden since 1991
- Very heavily regulated in for example Germany. Very strict regulation

Phase out of Trichloroethylene



- MC of abatement very flat
- Most firms substitute
- Some firms find it impossible & litigate
- Why not use P instrument
- Norway did!

Phase out of Trichloroethylene



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 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
- $P = c'_q + Te'_q(1 - \sigma_i) - T(E/Q)(1 - \sigma_i)$
- $c'_a = -Te'_a(1 - \sigma_i)$

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 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,