Overview and systematics of eco-political instruments / Some conclusions on their applications in Germany and their efficiency

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Eco-political instruments are defined (according to Wicke) as:

„those measures undertaken by government, by which goals of environmental policy can be achieved".

The most important instruments are **obligations (in particular standards), taxes and permits (in particular certificates)**. The application of these instruments can be supported by further accompanying measures (e.g. information, educational advertising, and appeal).

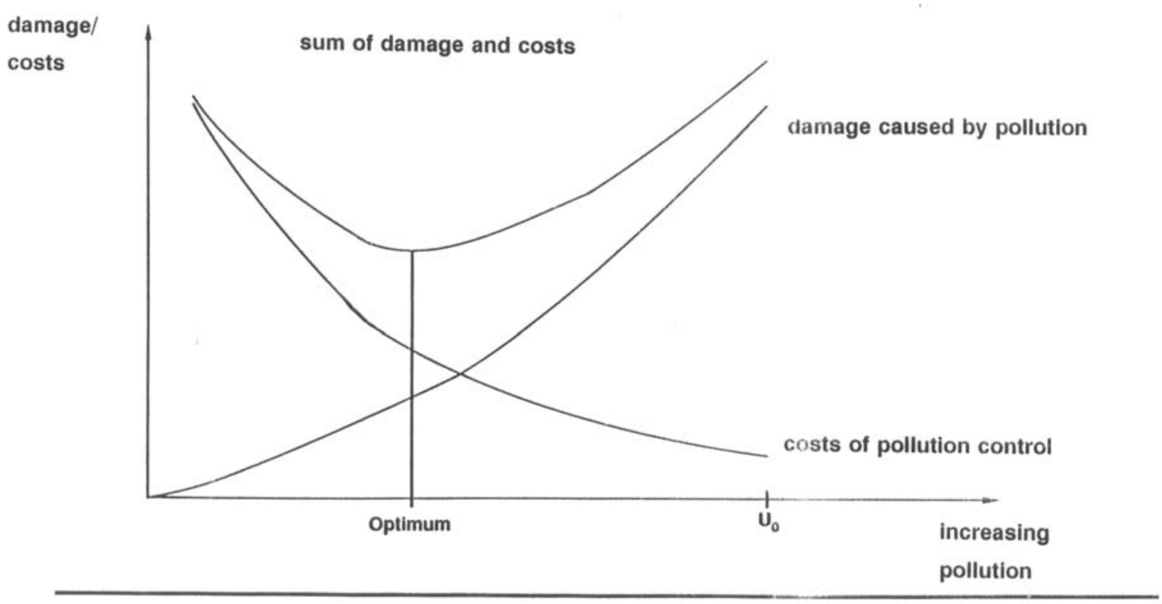
The optimal pollution control strategy

A pollution control strategy is defined as a bundle of pollution control measures for all users of environmental resources.
The **optimal pollution control strategy q** minimises the sum of the monetised environmental damage and the costs of pollution control:

$$D_q + C_q = \min.$$

where D_q = damage costs attached to the pollution remaining for strategy q,
C_q = costs of strategy q to reduce pollution.

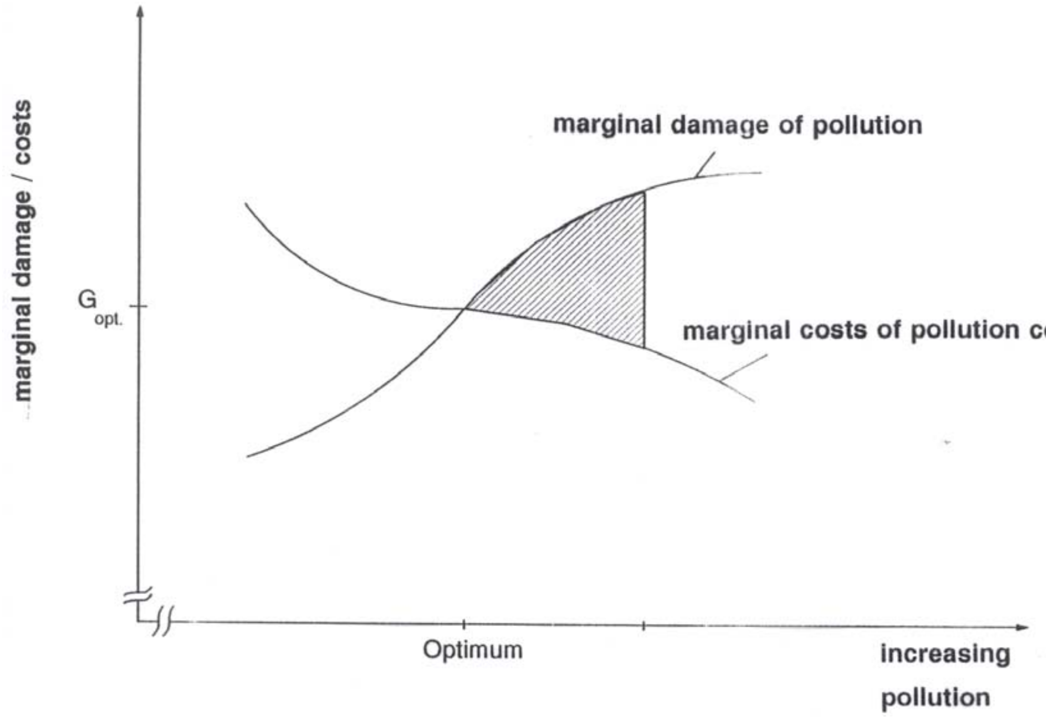
This optimal situation is graphically illustrated in the following diagram.



Optimal pollution control strategy

If both cost and damage functions are convex and differentiable, it is a necessary and sufficient condition of the optimal strategy that **the sum of marginal damage and marginal costs is zero.** Thus the optimal strategy has the shape as shown in the next diagram (where the derivatives of the first diagram are plotted):

Optimal pollution control strategy – marginal costs and damages



In principle, all major instruments - standards, taxes and permits - are able to reach this optimum. In the following a comparison is done to show the strengths as well as weaknesses of each of these instruments under consideration.

Criteria for Evaluating Instruments for Internalising External Costs

1. **Effectiveness**
2. **Capability to adjust to changing conditions**
3. **Incentive to achieve technical progress**
4. **Allocation of costs**

1. Criterion of effectiveness

What is the amount of the welfare loss that occurs if an eco-political instrument is used, compared to the realisation of the optimal strategy?

$$\Delta W_{qr} = D(EQ_q) - D(EQ_r) + C(EQ_q) - C(EQ_r) \leq 0$$

with

ΔW_{qr} = Welfare loss attached to the realisation of environmental quality level EQ_r
EQ_q = environmental quality level realised with optimal pollution control strategy
EQ_r = environmental quality level realised when instrument r is realised
$D(EQ_r)$ = damages realised at environmental quality level EQ_r
$C(EQ_r)$ = Costs of pollution control to reach environmental quality level EQ_r

This criterion includes both the evaluation of ecological effectiveness and of economic efficiency.

Criterion of effectiveness:
Reasons for deviations from the optimal strategy in practical performance:

Standards:

- Individual circumstances of polluters are not fully regarded, if the same standard is used for a class of polluters.
- Knowledge about measures for pollution control is lacking or limited.

Taxes and permits:

- A uniform tax or a uniform price for permits per unit of pollutant does not properly reflect the changes of marginal damage in space and time.
- Knowledge about measures for pollution control is lacking or limited.
- Indolence, resp. limited motivation, if the amount to be paid is small compared to turnover.
- Problems with the use of the measures (e.g. problems with waste disposal).
- Lack of capital.

In addition for permits:

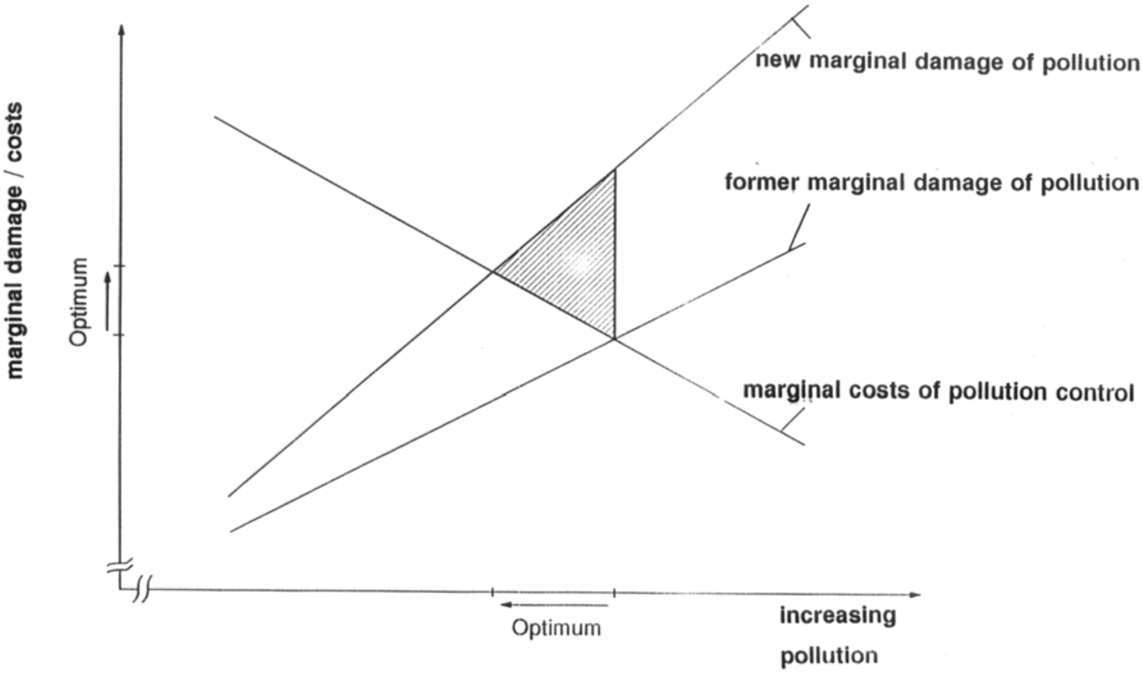
- Fluctuation of permit prices (similar to those on the stock market).

Criterion 2: Capability to Adjust to Changed Conditions

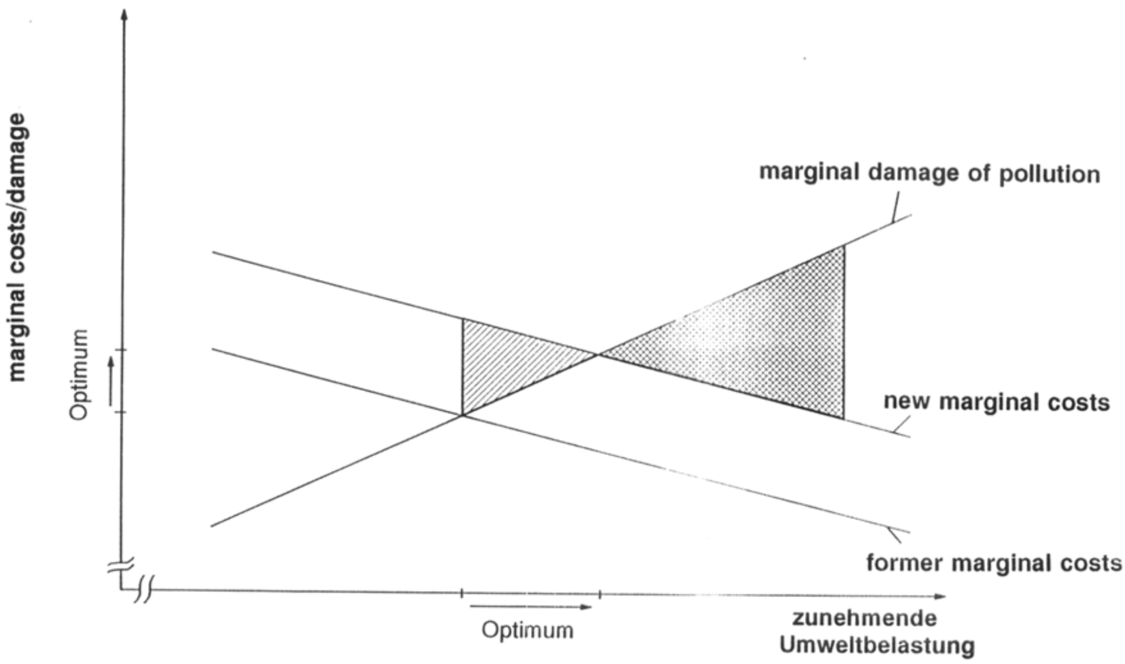
The optimal strategy changes, if:

- the damage function is altered (e.g. caused by better knowledge about the formation of damage, change in land use or population density, new possibilities to reduce the damage caused by pollution)
- the base pollution (without pollution control) changes (e.g. caused by a closure or opening of plants, changes in production, new production processes, changes in consumer habits)
- the cost function changes due to technical progress

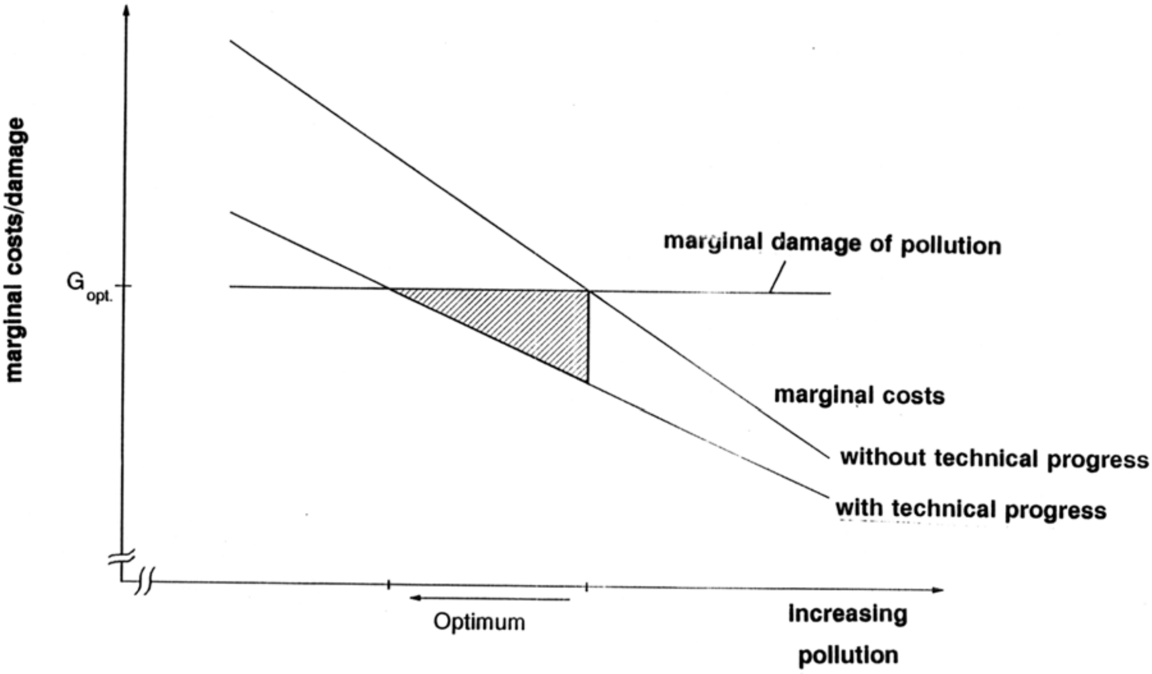
This criterion examines to what extent the new optimal strategy is reached without additional public action, after a change in conditions has occurred.



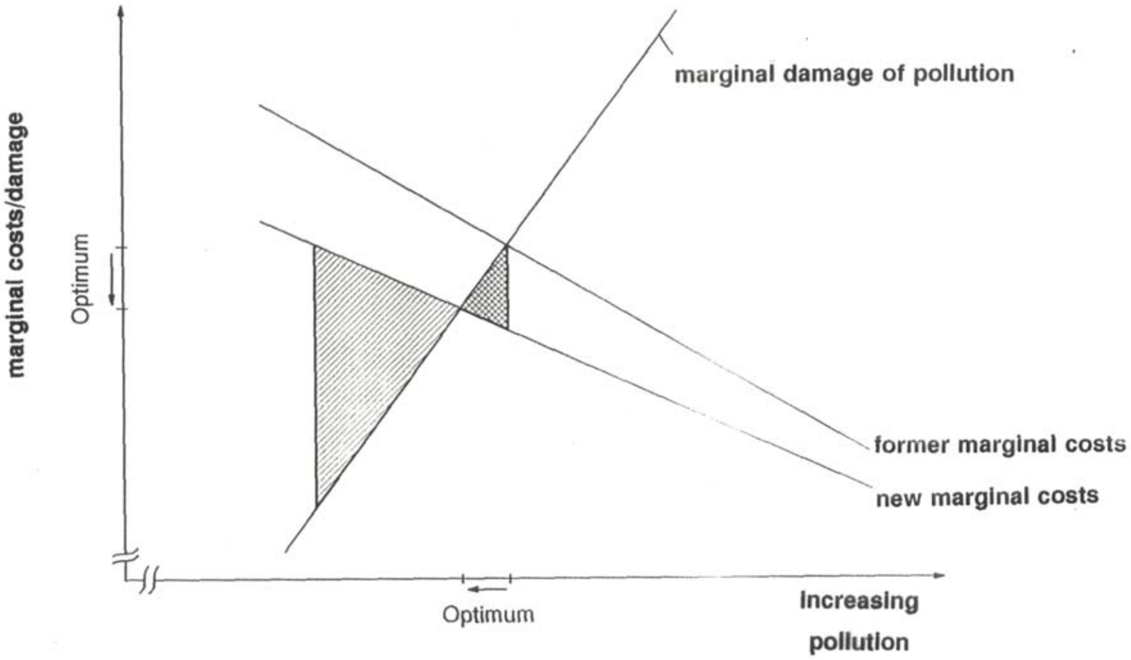
Optimal pollution control strategy in case of changes of the damage function



Optimal pollution control strategy in case of changes of the base pollution



Optimal pollution control strategy in case of technical progress I



Optimal pollution control strategy
in case of technical progress II

Summary of Criterion 2:

Capability to Adjust to Changed Conditions

Changes	Effects with		
	standards	taxes	permits
raise of damage[2)]	H	H	H
decrease of damage[2)]	L	L	L
raise of base emissions[3)]	O/H[1)]	O/H[1)]	L
decrease of base emissions[2)]	O/L[1)]	O/L[1)]	H
technical progress I[4)]	H	O/L[1)]	H
technical progress II[5)]	L	O/H[1)]	L

O = the new optimal strategy is realised
H = emissions are higher than optimal
L = emissions are lower then optimal
1) with linear/convex damage function
2) despite constant emissions
3) base emissions = emissions without emission reduction measures
4) the new technique increases the reduction of emissions
5) the new technique implies lower costs, but higher emissions

Criterion 3: Incentive to Achieve Technical Progress

With linear damage function:

- optimal with taxes;
- too small with permits

with convex damage function:

- too large with taxes;
- too small with permits

for standards:

- incentive to realise the standard with less costs
- no direct incentive to reduce pollution further
- indirect incentive to reduce emissions, if
  - ⇨ subsidies are given for research and development
  - ⇨ standards are changed, when new efficient pollution control techniques are available.

Criterion 4: Allocation of costs

Example: Reduction of SO_2 and NO_x emissions in Baden-Württemberg

Standards (current environmental policy):

Costs for pollution control: 500 Mio. €

Direct and indirect costs for industrial branches (determined with an input-output analysis):

average: 0.2 % of the net output value
maximum: 1.5 % of the net output value

Taxes and permits: 1.75 €/kg SO_2, 3.10 €/kg NO_x, same pollution level as with standards):

Costs of pollution control: 400 Mio. €
Taxes: 950 Mio. €

Direct and indirect costs for industrial branches:

average: 0.5 % of the net output value
maximum: 3.0 % of the net output value

Most effected branches are glass, pulp, cement, and iron industries.

If taxes are compensated by a general release of taxes for trade and industry, only the energy sector and the private households pay more than they paid before.

Summary

- If a **linear damage function** (i.e. with constant marginal damages) is assumed, taxes are best suited for internalising external costs.
- If the damage function is not known, the assumption of constant marginal damage is a useful hypothesis.
- In many cases, a linear damage function can be postulated only for a certain range of values. In that case, a combination of a tax with a limit for maximal pollution is recommended.
- Permits are preferable to constant taxes if marginal damage changes faster than marginal control costs near the optimum or if the optimum is located near a major discontinuity (step) of the damage function.
- Standards possess the following disadvantages:
  - ➪ Poor efficiency
  - ➪ Limited incentive to achieve technical progress in pollution control
  - ➪ Technical progress requires adaption of the standard.

- These disadvantages could be partly reduced by
  - ➪ Establishing differentiated standards
  - ➪ Support of research and development
  - ➪ Rapid adjustment of standards.
- The use of
  - ➪ standards
  - ➪ permits that are distributed free of charge
  - ➪ charges that are used to subsidize environmental control measures

  leads to prices that do not fully reflect the external effects.
- The additional revenue for the public authorities from taxes and permits should be compensated by general tax abatements.

Characteristics of an Optimal Pollution Control Strategy

- Levy of a tax per kg of pollutant (for example a tax of 1.75 €/kg SO_2 and 3.10 €/kg NO_x).
- Supply of information about techniques for pollution control.
- Limits for the ambient concentration of pollutants to protect human health.
- Compensation of additional revenue due to taxes by general tax abatements or reduction of the wage-cost factor.

Comparison of environmental instruments in regard to their applicability for a world-wide CO_2 reduction

Instruments / criteria	Standards	Taxes	Certificates
- **Economical efficiency**	-	+	+
- **Ecological efficiency**	+ (but narrowed due to exceptions for old plants)	- (Effects uncertain, Trial- and Error-method, permanent need for adjustment)	++ Problem: The **objective** must be well defined (thresholds) Since objectives are not exactly known, ecological efficiency declines
- **Dynamic incentive**	- null	+	(+) (depending from design)
- **Political enforceability**	+ (practicable, insightful)	(-) (not insightful for non-economists)	- (Decline of the population)
- **Costs of implementation/ administration/ monitoring**	(+) (despite high costs for monitoring)	(-) (ongoing monitoring necessary)	- (Environmental stock markets require large administrative efforts)

Legend: ++ excellent + good - poor

Comparison of environmental, energy and motor vehicle taxes and fiscal reforms in Europe

From the beginning of the 1990s to present, policies were undertaken all over Western Europe in order to implement new taxes as environmental policy instruments. As shown in the following chronologically arranged overview, several European countries have shifted the taxable base from income and associated employer outlay towards rationing limited environmental goods, in particular energy sources and CO_2-emissions. The German "Öko-Steuerreform" was not at all the precursor in this development.

Since the aim is that the overall national revenue from taxes shall remain constant, the share of income taxes and associated employer outlay decreased, and on the other hand, the taxes on energy and emissions increased at the same time.

**Energy-, CO_2- and environmental taxes in Europe –
modification of the tax assessment basis**

Country/ date of fiscal reform	*Tax shifting from old tax assessment basis*	*to new assessment basis*
Sweden 1990	**Personal income (reduction of tax rate of 4,3 %)**	**Environmental and energy taxes, including taxes on CO_2 and SO_2**
Belgium 1993	**Social insurance (reduction of employers contributions of 1,5 %)**	**Energy taxes**
Denmark 1993, 1995, 1998	**Personal income, employer contributions to social insurance, incentives for investment**	**Taxes on electricity, water, waste, motor vehicles, CO_2 and SO_2**
Netherlands 1996	**Personal income, corporate profits, employer contributions to social insurance**	**Energy and CO_2**
Finland 1997	**Personal income, employer contributions to social insurance**	**Taxes on depositing and CO_2**
Italy 1999	**Reduction of associated employer outlay/ social insurance contributions**	**Taxes on CO_2**
Germany 1999, 2000	**Employee and employer contributions to social insurance**	**Energy (mineral oil, natural gas and current)**
France 1999	**Tax reduction on the factor work; Compensations for companies which limit work to 35 hours per week**	**General tax polluting activities (covers among other things air pollution fees, waste taxes and water fees)**
Switzerland 1999, 2000	**Reduction of contributions to the health insurance**	**Taxes on volatile organic compounds and on light fuel oil (sulphur tax)**
Great Britain 2001	**Employer contributions to social insurance (reduction of 0,3 %)**	**„Climate-change-tax“ (raised on energy employment in enterprises) beginning April 2001**
Great Britain 2002	**Reduction of employer contributions to social insurance**	**Tax on bulk materials (winning of rock, sand and gravel) beginning April 2002**

Source: Speck and Ekins (2000)

Implementation of environmental/energy taxes: The ecological fiscal reform in Germany in more detail

A law entered into force 1999 as "access in the ecological fiscal reform", with it's aim proclaimed to "initiate energy saving by increasing energy costs, to foster energy saving technologies and to generate employment". The step-wise increase of petroleum taxes and the introduction of the new electricity tax is shown in the following.

Energy tax rates (net charging in consideration of tax abatement, refund and rebate) in respect to the

- **Gesetz zur Fortführung der Ökologischen Steuerreform (The law of continuation of the ecological fiscal reform), dating the 16 December 1999 and**
- **Gesetz zur Fortentwicklung der Ökologischen Steuerreform (amendment to the law of continuation the ecological fiscal reform) , dating 23 December 2002**

Product / Purpose	Unit	Until 31 Mar 1999	Since 1 Apr 1999	Since 1 Jan 2000	Since 1 Jan 2001	Since 1 Jan 2002	Since 1 Jan 2003
Fuels							
- Leaded gasoline	Ct/l	55,2	58,3	61,4	64,4	69,0	72,1
- Unleaded gasoline	Ct/l	50,1	53,2	56,2	59,3/60,8 [1]	62,4/63,9 [1]	65,5/67,0 [2]
- Diesel	Ct/l	31,7	34,8	37,8	40,9/42,4 [1]	44,0/45,5 [1]	47,0/48,6 [2]
Light fuel oil							
- Common rate	Ct/l	4,1	6,1	6,1	6,1	6,1	6,1
- Industry + agriculture and forestry, unless used for electricity generation	Ct/l	4,1	4,5	4,5	4,5	4,5	5,3
- Electricity generation	Ct/l	4,1	4,1	4,1	4,1	4,1	4,1
- CHP installations with monthly capacity factor = 70 %	Ct/l	4,1	-	-	-	-	-
- GSP installations without heat extraction with electric efficiency (net) = 57,5 %	Ct/l	4,1	4,1	-	-	-	-

Product / Purpose	Unit	Until 31 Mar 1999	Since 1 Apr 1999	Since 1 Jan 2000	Since 1 Jan 2001	Since 1 Jan 2002	Since 1 Jan 2003
Heavy fuel oil							
- Common rate	€/t	15,3/ 28,1*)	15,3/ 28,1 *)	17,9	17,9	17,9	25,0
- CHP installations with monthly capacity factor = 70 %	€/t	15,3 / 28,1 *)	-	-	-	-	-
- GSP installations without heat extraction with electric efficiency (net) = 57,5 %	€/t	28,1	28,1	-	-	-	-
Natural gas							
- Common rate	Ct/kWh	0,184	0,348	0,348	0,348	0,348	0,550
- Industry + agriculture and forestry, unless used for electricity generation	Ct/kWh	0,184	0,217	0,217	0,217	0,217	0,404
- Electricity generation	Ct/kWh	0,184	0,184	0,184	0,184	0,184	0,184
- CHP installations with monthly capacity factor = 70 %	Ct/kWh	0,184	-	-	-	-	-
- GSP installations without heat extraction with electric efficiency (net) = 57,5 %	Ct/kWh	0,184	0,184	-	-	-	-
- As CNG	Ct/kWh	0,956	1,012	1,069	1,125	1,180	1,240

1) Spreading of tax rate since the 1st November 2001: Increase of 1,53 Cent/ l for petrol/ diesel having sulphur content greater as of 50 mg/ kg, lower tax rate for low-sulphur fuel
2) Spreading of tax rate since the 1st January 2003: Increase of 1,53 Cent/ l for petrol/ diesel having a sulphur content greater as of 10 mg/ kg, lower tax rate for "sulphur-free" fuel
3) For use in heat generation 15,34 €/ t, for use in electricity generation 28,12 €/ t.
Public transport is only charged half of the increasing rates since the 1st January 2000.

Energy tax rates (net charging) in respect to

- **Gesetz zur Fortführung der Ökologischen Steuerreform (The law of continuation of the ecological fiscal reform), dating the 16 December 1999 and**
- **Gesetz zur Fortentwicklung der Ökologischen Steuerreform (amendment to the law of continuation the ecological fiscal reform) , dating 23 December 2002**

(continued)

Product / Purpose	Unit	Until 31 Mar 1999	Since 1 Apr 1999	Since 1 Jan 2000	Since 1 Jan 2001	Since 1 Jan 2002	Since 1 Jan 2003
Liquid gas							
- Common rate	Ct/kg	2,56	3,83	3,83	3,83	3,83	6,06
- Industry + agriculture and forestry, unless used for power generation	Ct/kg	2,56	2,81	2,81	2,81	2,81	2,81
- Power generation	Ct/kg	2,56	2,56	2,56	2,56	2,56	2,56
- CHP installations with monthly capacity factor = 70 %	Ct/kg	2,56	-	-	-	-	-
- GSP installations without heat extraction with electric efficiency (net) = 57,5 %	Ct/kg	2,56	2,56	-	-	-	-
- Fuel in other cases	Ct/kg	31,32	33,23	35,15	37,07	38,99	40,90
- Fuel for actuation of vehicles	Ct/kg	12,32	13,07	13,83	14,58	15,34	16,10
Electricity							
- Common rate	Ct/kWh	-	1,02	1,28	1,53	1,79	2,05
- Night storage heater *)	Ct//kWh	-	0,51	0,64	0,77	0,89	1,23
- Public transport, railway	Ct//kWh	-	0,51	0,64	0,77	0,89	1,02
- Industry + agriculture and forestry, unless used for power generation	Ct//kWh	-	0,20	0,26	0,31	0,36	1,23

*) Unless installed before the 1st April 1999, otherwise common tax rates

The greater part of the expected additional tax revenues shall be used for additional allocations of the Federal Government to the statutory pension insurance and thus to reduce the contribution rates. The expected additional revenues shall increase in 5 steps and finally revenue 15 billion € annually (additive purchase taxes).
The energy tax revenues in the last years before and after the implementation of the first step of the fiscal reform are shown in the following table, itemised in detail for fuel type and usage.

Energy tax revenues for the Federal Republic of Germany in million € - Comparison of the year before and after the introduction of the environmental tax reform

Product	Tax revenue 1998	Tax revenue 1999
Fuel		
- Leaded gasoline	1	0
- Unleaded gasoline	20427	21226
- Diesel	10262	11376
Light fuel oil	1579	1749
Heavy fuel oil		
- For heat generation	22	15
- For electricity generation	15	6
Natural gas		
- For heat generation	1559	1860
- For electricity generation	2	3
Liquid gas		
- For heat generation	41	43
- For electricity generation	26	16
Aeronautical fuel		
- Leaded aeronautical fuel	15	16
- Aircraft turbine fuel	14	11
Electricity	-	1816
Others *)	130	122
Total	34091	38259

*) including variations between target and actual revenues

For „natural gas“, „electricity“ and „total“, the according revenues are displayed, while for the other products the according target revenues are displayed.
The further development of the revenues from petroleum and electricity taxes up to and including 2002 is shown in the following table (values partly estimated):

Actual revenues		1999	2000	2001 [1)]
		in billion €		
Total petroleum tax		36,4	37,8	40,5
thereof:	Fuil oils	1,8	1,8	2,2
	Natural gas	1,9	2,1	2,1
	Other mineral oils (fuels)	32,8	33,9	36,2
Electrictiy tax		1,8	3,4	4,2

1) Estimation of the task force “revenue estimation”, November 2001
Source: Federal Ministry of Finances

Allocative and intergenerational effects of an environmental tax reform in Germany – A quantitative analysis with an overlapping generations model

A recent study at the Institute of Energy Economics and the Rational Use of Energy (Pahlke 2000) [1] - has been the first one in Germany that considers both the allocative and the intergenerational effects of a unilateral environmental tax reform for Germany. An environmental tax reform is defined by the introduction of carbon taxes combined with a simultaneous budget neutral reduction of existing taxes or other governmental levies. Note that this characteristic feature of budget neutrality has also always been stressed by the German government of the legislation period 1998 – 2002 when the “real” environmental tax reform was introduced– although the assumptions of this study described (that was started years before the time of this legislation) have not been identical to the actual tax reform for Germany.

From the analysis of the theoretical literature it has become evident that a quantitative analysis is needed. Dynamic applied general equilibrium models represent a consistent method to examine both the allocative and the distributive elements of an environmental tax reform.

Both the (more “simple”) Ramsey model and the overlapping generation model (egoistic and altruistic) have been examined, and to answer the questions for the intergenerational effects of the tax reform the overlapping generations model obviously can present the most differentiated results, so this model is chosen for the subsequent simulations.

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1 Pahlke, Andreas: Allokative und intergenerative Effekte einer ökologischen Steuerreform . Reihe: Quantitative Ökonomie, Band 112. Lohmar 2000. (Ph. D. dissertation written at the IER, University of Stuttgart (in German, with English summary).

On the basis of parameters, such as e. g. demand and supply elasticities (estimated from German economy data), scenarios are developed; a cost effectiveness analysis is used to analyse the impact of a carbon dioxide reduction over time and a refund policy. The revenues of the CO_2 taxes are used (in four alternative cases) either to reduce taxes on labour, capital, consumption or for a lump-sum transfer to the households. The evaluation of simulation results shows that the environmental tax reform results in economic losses; gross domestic product, employment, and investment are reduced. This occurs independently of the way the carbon tax is refunded, the differences between the four alternatives can be explained in a plausible way but are minor in quantitative terms.

Furthermore it is evident that – in the intergenerational, i. e. "sustainability" perspective that has often been neglected in this context in previous studies – that an environmental tax reform has substantial effects on the intergenerational distribution. To elucidate this, within the framework the households have been modelled as overlapping generations with an increment of ten years each and an overall time frame of more than 100 years.

Depending on their age, households are characterised by different earning possibilities. In the younger part of his life, the household saves part of his income and buys shares of the existing capital stock. When he becomes old, he has no more labour income, and thus he sells his shares in order to finance his consumption.

Compared to the reference case of economic growth without the tax reform, both the carbon taxes and refund policy influence the value of the existing capital stock. Depending on their amount of saved capital, the households may either suffer windfall profits or losses. Hence an environmental tax reform results in redistribution among the households, which can be substantial for some cohorts of households. The results show that in tendency only the first generations (living at the time the environmental tax reform is introduced) gain an increase in welfare at the expense of future generations; thus (under the assumptions of the model) the environmental tax reform under consideration cannot be regarded as sustainable.

Necessity of a relevant tax base: The example of fuel/car taxation

As shown in the following example, the purchase and usage of vehicles is also taxed quite differently in the European Community. It may be said that the transport or vehicle sector may be only indirectly connected with electricity generation; however it has to be pointed out that this example seems nevertheless relevant for our question regarding environmental instruments and the market liberalisation:

The series of ExternE has revealed that transport processes are indeed relevant processes (in quantitative terms) of the fuel cycles, depending on the type. Especially this is evident when life-cycle analysis is applied – renewable energy has in its construction and dismantling stage a larger share of transport processes. See also that e. g. large hydro plants may induce an increase of traffic by necessary detours. In the countries of South America under consideration with large distances and a comparatively low and very heterogeneous population density this aspect might have even more relative importance.

One logical follow-up thought is that if liberalisation changes the "electricity mix", the amount and structure of transport processes will be changed as well, so the "right" or "sub-optimal" taxation of transport and/or fuel might have an influence on the final calculation costs of the operators.

Finally the following example elucidates that the question of the “right” tax base is crucial for the answer whether an “eco-tax” is efficient for this purpose , and can be transferred to other energy taxes.

Basically, motor vehicle taxes and petroleum taxes can be considered as ecological instruments that are to contribute to the internalisation of damages resulting from the use of motor vehicles. However, motor vehicle tax is only able to refer to the **endangerment potential** with distinguishing different damage causing categories. This tax does not meet the actual ecological burden. The average fixed costs from this tax decrease with increasing use.

In contrast, petroleum tax can refer to the actual usage-dependent burdens (air pollutants and greenhouse gases). In case the demand is to be determined by the differently limited supply of roads (problem of certain jammed roads and cities) then petroleum tax is not precise either. Then only usage-depending taxes come into question. They can differ according to time and location so that in peak load periods the highest user fees are due while in periods of low usage only little fees have to be paid. Revenues can be used to improve public transport.

Motor Vehicle Taxation Levels in the EU

Country	*VAT*	*Passenger Cars*	*Commercial vehicules*	*Registration Fee*
Belgium	21 %	Cylinder capacity + age	-	62 €
Denmark	25 %	105 % up to 7.438 €, 180 % on the remainder	< 2 t: 95 % of value exceeding 1.735 €; 2-4 t: 30 % of value exceeding 4.304 €	144 €
Germany	16 %	-	-	26 €
Spain	16 %	< 1,6 l: 7 %; > 1,6 l: 12 %	-	62 €
France	19,6 %	-	-	16 € - 30 € + parafiscal fee
Greece	18 %	New car: 7 – 88 %	New vehicle: 6 – 26 %	-
Ireland	21 %	< 1,4l: 22,5 %; 1,4l – 2l: 25 %; > 2l: 30%	Light-commercial vehicules : 13,3 %; others : 51-127 €	-
Italy	20 %	Regional tax on licensing and transfer of ownership	Regional tax on licensing and transfer of ownership	151 € – 453 €
Luxembourg	15 %	-	-	29 €
Netherlands	19 %	Petrol car: 45,2 % up to 1.540€; Diesel-PKW: 45,2 % up to 328 €	-	41 € - 42 €
Portugal	17 %	Based on cylinder capacity; for 1,6 l: 4.894 €	-	25 €
Austria	20 %	Based on fuel consumption, max. 16 % of net price	-	61 € -92 €

Motor Vehicle Taxation Levels in the EU (continued)

Country	*VAT*	*Passenger Cars*	*Commercial vehicles*	*Registration Fee*
Finland	22 %	100 % up to 824€ for petrol cars 774€ for diesel cars	-	-
Sweden	25 %	-	Tax on consumption, dependent on weight and pollution -	-
Great Britain	17,5 %	-	-	40 €

Motor Vehicle Taxation Levels in the EU - Taxation basis

Country	*Passenger Cars*	*Commercial Vehicles*
Belgium	Cylinder capacity	Dead-weight
Denmark	Fuel consumption, weight	Weight
Germany	cylinder capacity, pollution	Permissible total weight, pollution, noise
Spain	Horse power	payload
France	Cylinder capacity, age and district	Cylinder capacity, age, district, weight
Greece	Cylinder capacity	Payload
Ireland	cylinder capacity	Dead-weight
Italy	kW	< 12 t: payload; > 12 t: weight and number of axes
Luxembourg	Horse power	weight
Netherlands	Dead-weight, province, fuel	Dead-weight
Austria	kW; Horse power	Maximum authorised gross weight
Portugal	Cylinder capacity + age	Gross weight, axles
Finland	84 – 118 €/year	Weight
Sweden	Weight	Weight, axles, fuel
Great Britain	CO_2 emissions	Laden weight

Source: Speck and Ekins (2000)

Some conclusions of motor vehicle taxation policy in Europe:

- The taxation of vehicles (both based on purchase and on the operating period) is only in few cases depending on or even proportional to the emerging damages (emissions and noise), therefore it does not have the character of a genuine eco-tax.
- Taxes referring to the cylinder capacity in the last years have implemented a stimulation for an technical engine development that is sub-optimal with regard to an ecological point of view.
- High taxes on the purchase of new vehicles (dependent on emissions or the fulfilling of norms) would probably have an greater incidence and pressure on car producers than taxes that emerge over several years.