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Odd Godal and Bjart Holtsmark

University of Oslo

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CICERO
Center for International Climate and
Environmental Research – Oslo
P.O. Box 1129 Blindern
N-0317 Oslo, Norway
Phone: (+47) 22 85 87 50
Fax: (+47) 22 85 87 51
E-mail: admin@cicero.uio.no
Web: http://www.cicero.uio.no

Contents

Tables

1 Introduction

The main aim of this paper is to describe how today's carbon dioxide (CO_2) tax scheme affects the various sectors of the Norwegian economy. Furthermore, we want to illuminate some possible distributive consequences that various climate policy designs could involve.

The common denominator for the chosen alternative policies are that the large cross-sectoral variations in tax rates that exists today are reduced and replaced by more equal and uniform regulation schemes. The effects on the distribution of costs of implementing policies where emissions are regulated more equally can contribute to understand the positions that were taken by the various members of the Green Tax Commission when these matters were discussed.

According to the Kyoto Protocol Norway is allowed to increase its emissions of greenhouse gases (GHGs) by one percent from 1990 to the first commitment period 2008-2012. The Norwegian emissions were in 1990, 55.2 million tonnes CO_2-equivalents (Mt CO_2-eqv.) and should consequently be below 55.8 Mt CO_2-eqv. as an average in the first commitment period.

Although the Norwegian emissions are allowed to increase, the Kyoto protocol constitutes a challenge also for Norway because the Norwegian emissions already in 1996 amounted to 59 Mt CO_2-eqv. Furthermore, they are expected to increase to 68.1 Mt in 2010 according to prognoses published by the Norwegian Ministry of Environment (St. meld. nr. 29, 1997-98). Hence, the emissions have to be reduced by 12.3 Mt relative to the business as usual scenario.

As Norway is part of the Kyoto-agreement, the debate on how Norway is to fulfil its commitments has recently gained momentum. It is advocated by an increasing number of actors that the present set of measures is neither sufficient nor appropriate in order to reduce emissions sufficiently. The present carbon dioxide tax varies both across the different fuels and across sectors emitting the gas, which in turn leads to a cost-ineffective distribution of the emissions. As shown by our second numerical example, the average greenhouse gas tax in Norway currently is 104 NOK pr tonne CO_2-eqvivalent, while the implemented tax rates vary between NOK 358 and zero.

It is reasonable to assume that sectors and sources being subject to the CO_2-tax of NOK 358 have implemented several high-cost abatement efforts, while sectors exempted from the CO_2-tax correspondingly have implemented few measures. A set of measures that broadens the basis of the emissions that are subject to restrictions will undoubtedly change the distribution of the costs that Norway must take in order to reach the agreed level of emissions. Due to the conventional wisdom that abatement cost curves are likely to have a strongly convex form, it is likely that a broader basis for the GHG emission tax together with uniform tax levels could trigger considerably increased efficiency in the Norwegian economy. The size of the efficiency gains is not calculated due to lack of data.

There are several ways in which today’s tax regime can be changed in order to secure a more cost-effective reduction of emissions. We present some numerical examples with more uniform emission tax rates. It is, however, important to underline that for the purpose of this analysis it is

not of major importance whether the new measures are based on taxes or tradable quotas. Because tradable quotas and emission taxes are quite similar policy instruments, a system with tradable emission permits will have the same distributional effects as a taxation regime. This depends however on the assumptions that the permits are distributed by auctions, that tax payments are not refunded and that the systems cover the same set of gases and activities.

Throughout this paper the price of one unit emission will be denoted as 'tax rate' regardless of the policy instrument applied. We also find it necessary to define the ambiguous term 'emission cost' as it is frequently used throughout the paper. In a tax regime a firm or household's emission cost is equal to the amount of emission taxes transferred to the government. In a regime with tradable quotas it will equal the quota price multiplied by the number of quotas held by the firm or the household. It is important to note that the price of a quota will equal the tax rate as long as the quota-market is well functioning and the total emissions are the same.

2 Current emissions

The emission data are delivered by the Statistics Norway (SSB, 1998a)[1] for the year 1995. There are data for CO_2, N_2O and CH_4 distributed across 39 sectors of the economy, 23 energy carriers and 3 type of sources. Here, the numbers are aggregated into suitable groups. The relatively high resolution was required to enable us to link emissions and taxes.

Emission data for the long-lived industrial greenhouse gases that are included in the Kyoto-agreement were provided, though not with the same degree of resolution. This did however not impose any major problem, as the emitters of any importance are point emissions with known origin.

The emissions from production of oil and gas and coastal and inland water transport cannot be directly connected to the definitions used in the carbon dioxide tax law. How these emissions are treated in this respect is explained in Appendix 1.

[1] We thank Statistics Norway for supplying us with detailed emission data in an electronic format.

Table 1: Green House Gas emissions in Norway 1995 expressed as million tonnes CO_2 equivalents[2]

Sector	Total	Taxed	Exempted from tax			
		CO_2	CO_2	CH_4	N_2O	OGHG[a]
Total	56.4	21.7	16.5	10.3	5.4	2.5
Agriculture	5.8	0.5	0.2	2.3	2.9	-
Forestry	0.1	0.1	-	0.0	0.0	-
Fishing etc	1.4	0.1	1.3	0.0	0.0	-
Production of Oil and Gas[b]	10.3	7.2	2.4	0.6	0.0	-
Manufacture of Food Products[c]	0.3	0.2	0.1	0.0	0.0	-
Manufacture of Pulp and Paper Articles	1.7	0.3	0.3	1.1	0.1	-
Emission Intensive Industry[d]	15.1	0.8	10.0	0.1	1.7	2.4
Other Industry	1.7	0.5	0.1	1.1	0.1	-
Production of Electricity	0.1	0.0	-	0.0	0.0	0.1
Construction	0.6	0.5	0.1	0.0	0.0	-
Other Services	2.2	2.0	0.1	0.0	0.1	0.0
Ocean Transport[e]	-	-	-	-	-	-
Coastal and Inland Water Transport	1.3	0.8	0.5	0.0	0.0	-
Other Transport[f]	4.1	2.7	1.3	0.0	0.0	-
Land Transport etc.	2.6	2.6	0.0	0.0	0.0	-
Air Transport[g]	1.3	0.0	1.3	0.0	0.0	-
Transport by Railways and Tramways	0.1	0.1	-	0.0	0.0	-
Defence	0.5	0.5	0.0	0.0	0.0	-
Local Government	5.3	0.2	0.0	4.9	0.1	-
Central Government	0.1	0.0	0.0	0.0	0.0	-
Private Households	5.9	5.2	0.0	0.3	0.3	-

Source: SSB, 1998a

[a] OGHG (Other Greenhouse Gases) includes the industrial gases HFC125, HFC134, HFC152a, CF4, C2F6 and SF6 which all are included in the baskets defined in the Kyoto Protocol.
[b] Includes oil and gas exploration and drilling and production and pipeline transport of oil and gas
[c] Includes manufacturing of herring meal
[d] Includes the manufacturing of industrial chemicals, metals, chemical and mineral products and petroleum refining.
[e] Emissions are not included, as they are not part of the Kyoto-protocol.
[f] This sector is an aggregate of the proceeding sectors land transport etc., air transport and transport by railways and tramways
[g] Only domestic air transport

[2] Emissions are converted to CO_2 equivalents using their global warming potential in a 100 years perspective. (IPCC, 1996)

3 The Norwegian CO_2 tax scheme

Of the greenhouse gases that are included in the Kyoto Protocol, only CO_2 is for the time being subject to emission taxation in Norway, cf. table 1. The present CO_2 tax scheme is mainly based on the sale of fossil fuel products. The carbon content in these products is a good indicator of the CO_2 emission resulting from the combustion.

In general, the CO_2 tax applies to the use of petrol, auto diesel, mineral oil, natural gas, coal and coke. The tax level varies however both across these energy carriers and across the various sectors of the economy. As a result of the exemptions, only about 60% of the total CO_2 emissions are subject to taxation. Furthermore, because CH_4, N_2O and the industrial gases are not subject to taxation, only 40% of the total Norwegian GHG emissions where taxed in 1995.

As is evident from table 1, there are seven main sectors with respect to GHG emissions:
1) agriculture,
2) production of oil and gas
3) emission intensive industry
4) transport
5) other services
6) local governments
7) private households.

Among these sectors, the emissions from production of oil and gas, transport, other services and private households are subject to taxation. The emissions from agriculture and local governments are mainly nitrous oxide and methane, and are consequently not taxed. The emission intensive industry is in general exempted from the CO_2 tax. A description of the exemptions in the tax scheme follows below. For more details, see Appendix 1

Table 2: The Norwegian CO_2 tax regime 1995.

Energy Carrier	**Tax level, NOK/ tonne CO_2**	**Sectors exempted/ sectors with reduced tax level**
Petrol	358	Practically no use exempted
Light Mineral Oil	156	Certain sectors exposed to international competition such as air transport, ships engaged in foreign trade, the supply fleet in the North Sea, fishing, and coastal goods transport are exempted. Wood conversion and the herring meal industry pays half the tax (78 NOK/tonne)
Heavy Mineral Oil	134	Certain sectors exposed to international competition such as air transport, ships engaged in foreign trade, the supply fleet in the North Sea, fishing, and coastal goods transport are exempted. Wood conversion and the herring meal industry pays half the tax (67 NOK/tonne)
Natural Gas	355	Onshore use of natural gas
Oil used on the Continental Shelf	312	
Coal	171	Coal used as a reducing agent or as raw material in industrial processes and for energy purposes in the production of cement and LECA (light expanded clay aggregate)
Coke	130	As for coal

Source: Norwegian Ministry of Environment, 1997

3.1 The collected tax revenues

As the CO_2 tax is included in other taxes on fossil fuels, the revenues do not appear separately in official tax income documents. We have, however, estimated the collected amount of revenues by applying the tax scheme and the belonging rates to the emission data. The results are presented in table 3.

The total revenue from the CO_2 tax is estimated to have been 5 859 million NOK in 1995. 2 557 of these millions stems from taxation of the use of natural gas in the production and transport of oil and gas. Petrol and auto diesel are other large sources for the collected revenue. One could note that if the CO_2 tax on coal and coke had been 358 NOK pr tonnes CO_2, the collected revenue from these two source would have been around 1,8 billion NOK – slightly below the revenue from the CO_2 tax on petrol.

Table 3: Emissions subject to tax, revenues and emissions exempted from tax, 1995.

Energy carrier	**Subject to tax**		**Exempted from tax**
	Emissions Mill. tonnes	**Revenue** Mill. NOK	**Emissions** Mill. tonnes
Total	21.7	5 859	16.5
Coal	0.1	19	3.4
Coke	0.0	1	1.6
Petrolcoke	0.0	0	0.6
Wood	-	-	-
Natural Gas	7.2	2 556	0.7
Other Gas	-	-	2.1
LPG	-	-	0.3
Petrol-car	5.2	1 874	-
Petrol-other	0.0	2	-
Domestic Paraffin	0.5	76	-
Jet-paraffin	0.3	48	1.3
Autodiesel	4.3	674	-
Marine Fuel	0.8	126	2.8
Heating Oil	1.9	302	0.0
Special Distillate	0.6	88	0.0
Heavy Ind. Oil	0.7	92	0.3
Crude Oil	-	-	0.7
Waste	-	-	0.1
N-compounds	-	-	0.9
Ca-compounds	-	-	1.0
Solvents	-	-	0.1
Ore	-	-	0.1
Special Waste	-	-	0.1

4 Allocation effects of removing exemptions

We will in this section analyse some possible effects of removing exemptions from the tax scheme. It is, however, important to bear in mind that when a sector is subject to new prices on emissions, it will adapt their new emissions to these prices. Due to the lack of data about elasticities, we have not been able to incorporate these effects and must hence consider the emission by each sector to stay constant. The results are therefore to be considered only as indications of how emissions and costs will be distributed under other regimes.

The analysis will also indicate how changes in the distribution of emission costs will affect different sectors by comparing the change in costs to operating profits today and to the number of employees in the sector. The first can give an indication about how seriously the sector is affected economically. The latter can be interpreted in at least two ways. Either as how difficult it will be to run business with high costs per employee or as business that can close down without putting too many people out of work. The operating profits and the number of employees are presented in table 4.

Table 4: Number of employees, operating profits[h] and average CO_2 tax rate[i] 1995

Sector	**Employees** 1000	**Operating Profits** Mill. NOK	**Average CO_2 tax rate** NOK/tonne
Total	1 809	220 239	154
Agriculture	66	11 166	118
Forestry	5	2 201	172
Fishing etc	17	3 541	12
Production of Oil and Gas	21	60 755	265
Manufacture of Food Articles	50	5 318	97
Wood Conversion	11	2 899	72
Emission Intensive Industry	51	8 587	12
Other Industry	172	9 031	129
Production of Electricity	19	8 984	211
Construction	99	9 698	150
Other Services	641	65 640	236
Ocean Transport	41	542	-
Coastal and Inland Water Transport	9	-457	99
Other Transport	82	13 772	112
Land Transport etc.	n.av.	n.av.	165
Air Transport	n.av.	n.av.	2
Transport by Railways and Tramways	n.av.	n.av.	156
Defence	45	n.ap.	156
Local Government	382	n.ap.	152
Central Government	97	n.ap.	158
Private Households	4 348	n.ap.	311
Other	1	18 562	-

Source: SSB 1998b

[h] n.av. means not available, n.ap. means not appropriate, and n.c means not calculated.

[i] The average CO_2 tax rate is calculated by dividing the revenues from each sector by its total CO_2 emissions.

4.1 Numerical examples

We will present three numerical examples. In all three examples we have chosen to keep the expected total revenue constant and equal to the collected revenue from the CO_2 tax in 1995. This is not done because the current tax income necessarily is optimal, but rather because the approach makes it more feasible to compare how the distribution of costs varies across the different numerical examples. The characteristics of the three numerical examples are as follows:

Example 1	The current set of CO_2 taxes and exemptions, cf. table 1,2 and 3, is replaced by a uniform CO_2 tax on all CO_2 emissions. CH_4, N_2O and Other GHGs are exempted to taxation.
Example 2	The current set of CO_2 taxes and exemptions, cf. table 1,2 and 3, is replaced by a uniform GHG tax on all gases listed in the Kyoto protocol. The tax level is uniform both across sectors and gases.
Example 3	The tax system is similar to the one in example 2. The difference being that there is no tax on CH_4-emissons from agriculture and waste, N_2O-emissions from agriculture and evaporation emissions from crude oil and solvents.

4.2 Numerical example 1

For the purpose of this study it is of interest to show which sectors that benefit from the present taxation scheme with regard to carbon dioxide emissions. In numerical example 1 we will therefore enforce a uniform taxation level for all carbon dioxide emissions. The tax rate was found by dividing today's revenues by total CO_2 emissions in 1995, which equals about 154 NOK per tonne CO_2. The results appear in table 5.

Table 5: Numerical example 1. Effects on emission costs, costs per employee and reduction in operating profits[j]: A revenue neutral transition to uniform treatment of all CO_2-emissions.

Sector	Emission Costs		Change in emission costs		
	Reference	Numerical Example 1	Value	Per Empl.	Per Profit
	Mill. NOK	Mill. NOK	Mill. NOK	NOK/Empl	Per cent
Total	5 859	5 859	-	-	0,0 %
Agriculture	75	98	23	343	0,2 %
Forestry	9	8	-1	-183	0,0 %
Fishing etc	16	206	191	11 081	5,4 %
Production of Oil and Gas	2 557	1 483	-1 075	-50 693	-1,8 %
Manufacture of Food Products	32	50	19	372	0,3 %
Manufacture of Pulp and Paper Articles	42	89	48	4 359	1,6 %
Emission Intensive Industry	126	1 669	1 543	30 021	18,0 %
Other Industry	79	94	15	87	0,2 %
Production of Electricity	7	5	-2	-104	0,0 %
Construction	83	85	2	22	0,0 %
Other Services	499	324	-174	-272	-0,3 %
Ocean Transport	-	-	-	-	0,0 %
Coastal and Inland Water Transport	131	204	73	8 439	-15,9 %
Other Transport	451	620	169	2 067	1,2 %
Land Transport etc.	431	401	-30	n.c.	n.c.
Air Transport	2	202	199	n.c.	n.c.
Transport by Railways and Tramways	17	17	-0	n.c.	n.c.
Defence	71	70	-1	-27	n.c.
Local Government	37	38	1	1	n.c.
Central Government	8	8	-0	-2	n.c.
Private Households	1 635	807	-828	-190	n.c.

[j] Negative numbers indicate benefits (reduced costs) and positive numbers increased costs. The exception is the sector Coastal and Inland Water Transport where operating revenues were negative in 1995. The negative fraction costs per profit indicate that the profits will become more negative.

From table 5 it appears that a uniform tax of 154 NOK pr. tonne on all CO_2-emissions will have little effect on the profits in agriculture because methane and nitrous oxide dominates this sector's emissions. Fishing is however subject to increased costs as their use of marine fuels today are exempted. The production of oil and gas will have substantial benefits, as the CO_2-tax paid on the continental shelf is considerably higher than the average. However, as final profits in this sector is subject to more than 80% governmental tax, the petroleum producing companies will keep only a small part of these benefits.

The numerical example illustrates that a uniform CO_2-tax would heavily affect the emission intensive industry, as this sector have large emissions that are exempted from taxation today. The cost per employee and the reduction in operating profits are the highest among all sectors.

The construction sector experience benefits in example 1, as it pays CO_2-tax on almost 90% of its emissions. The effect on profits and costs per employee are however not very large. The increased costs for the transportation of goods in the coastal and inland water transport sector are lager than the figures in the table indicate, as the transportation of passengers also are included in this sector. The latter are today subject to taxation and will experience benefits.

Ocean transport is not affected as these emissions are not part of the Kyoto Protocol and therefore assumed to be exempted for taxation. Land transport, which is dominated by the use of auto diesel, will have benefits where as air transport will have increased costs. Governmental activities will not be affected by a uniform CO_2 tax as emissions here are primarily methane from waste sites.

Private households will experience large benefits as they are subject to the highest CO_2 taxes today. The reduction in the CO_2 tax rate from 358 NOK/tonnes to 154 corresponds to a reduction in the petrol price of approximately 0.50 NOK/litre which equals 6% compared to a price of NOK 8 per litre.

4.3 Numerical example 2

In the first numerical example only CO_2-emissions were subject to taxation. However, also CH_4, N_2O, HFCs, PFCs and SF_6 are included in the commitments defined in the Kyoto Protocol. In numerical example 2 we therefore analyse the effect of including all green-house gases that counts in the Kyoto-context. The appropriate tax level to apply is hence the total revenue divided by the total emissions of these gases measured in carbon dioxide equivalents, which equals 104 NOK per tonne CO_2 equivalent. The results are presented in table 6.

Table 6: Numerical example 2. Effects on emission costs, costs per employee and reduction in operating profits: A revenue neutral transition to uniform treatment of emission of all GHGs.

Sector	Emission Costs		Change in emission costs		
	Reference	Numerical Example 2	Value	Per Empl.	Per Profit
	Mill. NOK	Mill. NOK	Mill. NOK	NOK/Empl	Per cent
Total	5 859	5 859	-	-	0,0 %
Agriculture	75	605	530	7 981	4,7 %
Forestry	9	6	-4	-660	-0,2 %
Fishing etc	16	141	125	7 272	3,5 %
Production of Oil and Gas	2 557	1 065	-1 492	-70 366	-2,5 %
Manufacture of Food Products	32	36	4	78	0,1 %
Manufacture of Pulp and Paper Articles	42	181	140	12 813	4,8 %
Emission Intensive Industry	126	1 572	1 446	28 130	16,8 %
Other Industry	79	178	99	577	1,1 %
Production of Electricity	7	10	2	123	0,0 %
Construction	83	59	-24	-245	-0,2 %
Other Services	499	233	-266	-415	-0,4 %
Ocean Transport	-	-	-	-	0,0 %
Coastal and Inland Water Transport	131	139	8	916	-1,7 %
Other Transport	451	423	-28	-339	-0,2 %
Land Transport etc.	431	274	-158	n.c.	n.c.
Air Transport	2	138	135	n.c.	n.c.
Transport by Railways and Tramways	17	12	-5	n.c.	n.c.
Defence	71	48	-23	-515	n.c.
Local Government	37	550	512	1 341	n.c.
Central Government	8	6	-3	-27	n.c.
Private Households	1 635	608	-1 027	-236	n.c.

If we compare example 2 with example 1, it is evident that the farmers would prefer that only CO_2 was included in the regulation regime. If both methane and nitrous dioxide are included, the profit in the agriculture sector is reduced by 4.7 percent.

Waste sites owned by local government will be subject to severe cost increases. This sector is currently exempted from emission taxation but according to political measures that may be adopted in the near future, a tax on disposal of waste can be implemented. About 50 % of the increased cost in this sector is estimated to fall on private households (St prp nr 54, 1997-98).

It is also interesting to note that the emission intensive industry should prefer that all gases are included in the climate policy regime as in example 2, instead of the regime presented in example 1, even though this sector has significant emissions of the industrial GHGs. This is because the taxation of the CH_4 and N_2O emissions from waste and agriculture contributes to lower the general tax rate more than enough to compensate this industry for increased expenses on the industrial GHG emissions. Furthermore, this result is coherent with the emission intensive industry's position in this matter when they promote a regulation scheme where all gases are

included. This position is also supported by the fact that the emissions of industrial GHG have been reduced significantly in recent years.

The effects on other sectors under numerical example 2 are of the same character as in numerical example 1, though the effects are of smaller magnitudes. A reduction of the current CO_2-tax on petrol to 104 NOK/tonne CO_2 (numerical example 2) corresponds to a reduction of the petrol price of 0.60 NOK pr litre.

4.4 Numerical example 3

Even though one, in the near future, can expect a regulation scheme where a larger part of the greenhouse gas emissions are included, it is unlikely that all emissions will be part of the same scheme immediately. The main reason for this is that some emissions are difficult to monitor and control and are not tied up with any product.

The most important emissions in this respect are CH_4 and N_2O emissions from agriculture and CH_4 from waste and evaporation emissions of CO_2 from crude oil and solvents. If we exclude these emissions from the regulation scheme and apply a revenue neutral tax rate of 137 NOK per tonne CO_2 equivalent, the distribution of emission costs becomes as presented in table 7.

Table 7: Numerical example 3. Effects on emission costs, costs per employee and reduction in operating profits: A revenue neutral transition to uniform treatment of all GHG emissions except CH_4-emissons from agriculture and waste, N_2O-emissions from agriculture and CO_2 emissions from evaporation from crude oil and solvents.

Sector	Emission Costs		Change in emission costs		
	Reference	Numerical Example 3	Value	Per Empl.	Per Profit
	Mill. NOK	Mill. NOK	Mill. NOK	NOK/Empl	Per cent
Total	5859	5 859	-	-	0,0 %
Agriculture	75	89	14	211	0,1 %
Forestry	9	8	-2	-322	-0,1 %
Fishing etc	16	186	170	9 874	4,8 %
Production of Oil and Gas	2557	1 353	-1 204	-56 795	-2,0 %
Manufacture of Food Products	32	47	15	305	0,3 %
Manufacture of Pulp and Paper Articles	42	82	40	3 694	1,4 %
Emission Intensive Industry	126	2 045	1 919	37 329	22,3 %
Other Industry	79	80	1	6	0,0 %
Production of Electricity	7	13	5	283	0,1 %
Construction	83	73	-10	-104	-0,1 %
Other Services	499	285	-213	-333	-0,3 %
Ocean Transport	0	-	-	-	0,0 %
Coastal and Inland Water Transport	131	183	52	6 029	-11,3 %
Other Transport	451	557	106	1 298	0,8 %
Land Transport etc.	431	360	-71	n.c.	n.c.
Air Transport	2	181	179	n.c.	n.c.
Transport by Railways and Tramways	17	15	-2	n.c.	n.c.
Defence	71	63	-8	-183	n.c.
Local Government	37	34	-3	-9	n.c.
Central Government	8	7	-1	-13	n.c.
Private Households	1635	755	-880	-202	n.c.

In numerical example 3, agriculture and waste sites (local government) are exempted and will not experience any important changes compared with today, which of course is a good situation for the farmers. For emission intensive industries, numerical example 3 is the most expensive as all gases in this sector are subject to taxation while CH_4 and N_2O emissions from waste and agriculture are exempted. This makes the tax rate higher than in numerical example 2.

5 Conclusions

The general pattern of all numerical examples presented in this note is that sectors with emissions that today are exempted from taxation will have increased costs if they are included in a more general taxation scheme or in a system with tradable permits distributed by auctions. The most important sector in that respect is the emission intensive industry. This sector will experience emission costs per employee in the range of 28 000 to 37 000 NOK. The operating profits will be reduced in the range of 17-22 %. It is however important to note that these estimated effects are the average across all firms in the sector and there may be large intrasectorial variations.

Another interesting finding is that this sector should prefer that all gases are included in the policy regime. A likely scenario is however that CH_4 and N_2O from agriculture and waste are excluded from the regime due to the difficulties with monitoring and control. If that is the case the emission intensive industry could find it profitable to promote a system which only includes emissions of CO_2. If, on the other hand, abatement of the industrial gases in general are less costly compared to CO_2 abatement, the industry could possibly be expected to still promote a system that includes also the industrial gases PFCs and SF_6.

Some other important changes occur in the distribution of costs and benefits when a tax system or a system with tradable emission permits covers all greenhouse gases. The major changes are likely to occur in the agricultural and local governmental sectors. This is due to the emissions of methane (CH_4) and nitrous oxides (N_2O) in agriculture and to the methane (CH_4) emissions from waste sites.

As the production of electricity in Norway is based on hydropower, no numerical example will affect this sector.

When the Green Tax Commission in Norway presented their final report in 1996 (NOU, 1996) the proposal to even the variations in the tax level of CO_2 by subjecting presently exempted emissions to a CO_2 tax of NOK 50 per tonne CO_2 was not supported unanimously. The opposing stand taken by the representatives from the employers' (NHO) and the employees' (LO) federations, seems in the light of the above results, comprehensible. On the other hand, the LO also organises employees within the service sector which could experience substantial benefits by a tax shift away from tax on labour towards tax on emissions. This argument did however not seem to be of primer importance to the representatives of the LO when positions were chosen.

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St. prp. nr. 54 (1997-98): Grønne skatter, Finans- og tolldepartementet.

Appendix 1

A detailed description of how the CO_2 tax scheme is applied to the emission data follows below. The tax rates are in general connected to the energy carrier as is shown in table A1.

Table A 1: CO_2 taxes by energy carrier and emission source. NOK /tonne CO_2, 1995.

Nr	Energy Carrier	Tax rate, NOK/tonne Emissions related to	
		Combustion	Process
1	Coal	171	0
2	Coke	130	0
3	Petrolcoke	130	0
4	Wood	0	0
5	Natural Gas	0	0
6	Other Gas	0	0
7	LPG	0	0
8	Petrol-car	358	358
9	Petrol-other	358	358
10	Domestic Paraffin	156	156
11	Jet-paraffin	156	156
12	Autodiesel	156	156
13	Marine Fuel	156	156
14	Heating Oil	156	156
15	Special Destillate	156	156
16	Heavy Ind. Oil	134	134
17	Crude Oil	0	0
18	Waste	0	0
19	N-compounds	0	0
20	Ca-compounds	0	0
21	Dissolvents	0	0
22	Ore	0	0
23	Special Waste	0	0

Source: NOU, 1996

There are however some exemptions to this general rule. The exemptions are listed in table A2. (To identify the corresponding names to the sector numbers and the energy carrier numbers see table A3 and A1.)

Table A 2: Exemptions to the general tax scheme.

Emission Source	Sector Nr.	Energy Carrier Nr.	Tax rate NOK/tonne
Stationary	21	14	78
	21	15	78
	21	16	67
	27	1	0
	27	2	0
	27	3	0
	34	14	78
	34	15	78
	34	16	67
	64	5	326,0
	64	6	355
	64	7	355
	64	13	0
	68	5	355
	68	6	355
	68	7	355
Mobile	13	13	0
	64	13	0
	68	13	0
	76	11	0
	78	13	84,0
Prosess	64	17	0

There are in particular two exemptions that should be noted. The burning of natural gas in the offshore production of oil and gas (sector 64, energy carrier number 5) is taxed at a rate of 355 NOK/tonne. In the emission statistics, the emission from this energy carrier/sector amounts to 7 784 210 tonnes CO_2. However, according to the data source (SSB, 1998a) 635 316 tonnes of this emission are from onshore installations and are therefore not subject to taxation. The average tax on sector 64, energy carrier number 5 is therefore 355x(7 784 210-635 316)/7 784 210, which equals 326 NOK/tonne.

The other important exemption is the use of marine fuels in the sector coastal and inland water transport (energy carrier number 13, sector 78). This sector consists of both the transportation of goods and the transportation of passengers. The first is exempted from taxation whereas the latter is subject to taxation. According to Flugsrud and Rypdal, 1996, the emission in 1993 from these two sources where in 1993, 0.6 Mt CO_2 (goods) and 0.7 (passengers). We assume the same distribution of the emissions in 1995 as in 1993. The effective tax on emissions from energy carrier number 13, sector 78 is therefore 156x0.7/(0.7+0.6) which equals 84 NOK/tonne.

It is also important to note that all emissions from the preserving and processing of fish, sector 21, are assumed to stem from the herring meal industry. Although it is known that there are other industries included here, we have, due to lack of available information, not been able incorporate such considerations.

An overall view of how the emissions are distributed across sectors, energy carriers, emission sources and whether they are subject to taxation or not are presented through tables A3 to A10. Columns with zero emission for all sectors are omitted.

Table A 3: Stationary CO_2 emissions subject to taxation, 1995

CO2 emissions subject to taxation, 1995
Component: CO2
Emission source: Stationary
Unit: 1000 tonnes

Sector	Nr	All	Coal	Coke	Petrol-coke	Natural Gas	Domestic Parafin	Auto-diesel	Heating Oil	Special Destillate	Heavy Ind. Oil
			1	2	3	5	10	12	14	15	16
All		10 629	108	6	1	7 201	488	8	1 929	251	637
Agriculture	11	136	2	-	-	-	4	-	102	25	3
Forestry	12	-	-	-	-	-	-	-	-	-	-
Fishing etc.	13	-	-	-	-	-	-	-	-	-	-
Fish Farming	14	2	-	-	-	-	1	-	1	-	-
Manufacture of Other Consumption Goods	15	144	-	-	-	-	0	-	111	12	21
Manufacture of Textiles and Apparel	18	24	-	-	-	-	-	-	15	-	9
Preserving and Processing of Fish	21	85	-	-	-	-	0	-	12	30	43
Manufacture of Meat and Dairy Products	22	71	-	-	-	-	0	-	69	1	1
Manufacture of Wood and Wood Products	26	57	-	-	-	-	0	-	39	-	18
Manufacture of Chemical and Mineral Products	27	193	-	-	-	-	2	-	103	15	73
Printing and Publishing	28	4	-	-	-	-	0	-	4	0	-
Manufacture of Pulp and Paper Articles	34	283	25	-	-	-	0	-	5	2	251
Manufacture of Industrial Chemicals	37	171	-	-	-	-	-	-	27	23	121
Petroleum Refining	40	39	-	-	-	-	-	-	37	1	2
Manufacture of Metals	43	191	-	1	-	-	1	-	76	28	85
Manufacture of Metal Products, Machinery and Equipment	45	93	-	0	1	-	1	-	81	4	6
Building of Ships	48	11	-	-	-	-	0	-	11	-	0
Manufacture of Oil Production Platforms	49	11	-	-	-	-	0	-	10	-	1
Construction, excl. Oil Well Drilling	55	54	-	-	-	-	3	7	40	4	-
Finance and Insurance	63	9	-	-	-	-	0	-	6	3	-
Production and Pipeline Transport of Oil and Gas	64	7 149	-	-	-	7 149	-	-	-	-	-
Oil and Gas Exploration and Drilling	68	52	-	-	-	52	-	-	-	-	-
Production of Electricity	71	7	-	-	-	-	0	-	6	-	1
Land Transport etc.	75	14	-	-	-	-	0	-	14	-	-
Air Transport etc.	76	-	-	-	-	-	-	-	-	-	-
Transport by Railways and Tramways	77	6	-	-	-	-	-	-	6	-	-
Coastal and Inland Water Transport	78	2	-	-	-	-	-	-	-	2	-
Postal and Telecommunication Services	79	6	-	-	-	-	-	-	6	0	-
Wholesale and Retail Trade	81	240	-	-	-	-	8	-	206	25	0
Other Private Services	85	395	72	-	-	-	5	-	289	30	1
Defence	92S	47	-	-	-	-	0	-	47	-	-
Local Government Education	93K	54	-	-	-	-	-	-	52	2	-
Central Government Education	93S	16	-	-	-	-	-	-	15	1	-
Local Government Health-Care and Veterinary Services	94K	86	-	-	-	-	1	-	82	3	-
Central Government Health-Care and Veterinary Services etc.	94S	8	-	-	-	-	0	-	8	0	-
Other Local Government Services	95K	2	-	-	-	-	-	1	0	1	-
Other Central Government Services	95S	5	-	-	-	-	-	0	4	0	-
Water Supply and Sanitary Services	96K	15	-	-	-	-	-	-	15	-	-
Private Households	PH	946	10	5	-	-	462	-	430	39	0

Table A 4: Mobile CO_2 emissions subject to taxation, 1995

CO2 emissions subject to taxation, 1995
Component: CO2
Emission source: Mobile
Unit: 1000 tonnes

Sector	Nr	All	Petrol car 8	Petrol other 9	Jet Paraffin 11	Auto-diesel 12	Marine Fuel 13	Heating Oil 14	Special Destillate 15	Heavy Ind. Oil 16
All		11 021	5 216	7	309	4 310	809	7	315	47
Agriculture	11	328	13	-	-	315	-	-	-	-
Forestry	12	54	4	-	-	50	-	-	-	-
Fishing etc.	13	80	9	-	-	-	-	-	68	3
Fish Farming	14	4	2	-	-	-	2	-	-	-
Manufacture of Other Consumption Goods	15	68	10	-	-	48	10	-	-	-
Manufacture of Textiles and Apparel	18	7	1	-	-	5	1	-	-	-
Preserving and Processing of Fish	21	13	0	-	-	10	2	-	-	-
Manufacture of Meat and Dairy Products	22	38	2	-	-	30	6	-	-	-
Manufacture of Wood and Wood Products	26	16	1	-	-	12	3	-	-	-
Manufacture of Chemical and Mineral Products	27	178	4	-	-	161	13	-	-	-
Printing and Publishing	28	6	4	-	-	1	0	-	-	-
Manufacture of Pulp and Paper Articles	34	17	1	-	-	16	0	-	-	-
Manufacture of Industrial Chemicals	37	25	0	-	-	16	9	-	-	-
Petroleum Refining	40	14	0	-	-	11	3	-	-	-
Manufacture of Metals	43	31	0	-	-	25	6	-	-	-
Manufacture of Metal Products, Machinery and Equipment	45	37	4	-	-	26	7	-	-	-
Building of Ships	48	5	1	-	-	3	1	-	-	-
Manufacture of Oil Production Platforms	49	4	-	-	-	3	1	-	-	-
Construction, excl. Oil Well Drilling	55	430	37	-	-	345	41	7	-	-
Finance and Insurance	63	38	38	-	-	-	-	-	-	-
Production and Pipeline Transport of Oil and Gas	64	6	-	-	1	-	-	-	-	5
Oil and Gas Exploration and Drilling	68	-	-	-	-	-	-	-	-	-
Production of Electricity	71	28	10	-	-	18	-	-	-	-
Land Transport etc.	75	2 583	109	-	-	2 475	-	-	-	-
Air Transport etc.	76	7	-	7	-	-	-	-	-	-
Transport by Railways and Tramways	77	103	-	-	-	103	-	-	-	-
Coastal and Inland Water Transport	78	844	-	-	-	-	557	-	247	40
Postal and Telecommunication Services	79	113	100	-	-	13	-	-	-	-
Wholesale and Retail Trade	81	930	613	-	-	253	63	-	-	-
Other Private Services	85	233	182	-	11	41	-	-	-	-
Defence	92S	404	3	-	297	32	73	-	-	-
Local Government Education	93K	-	-	-	-	-	-	-	-	-
Central Government Education	93S	-	-	-	-	-	-	-	-	-
Local Government Health-Care and Veterinary Services	94K	-	-	-	-	-	-	-	-	-
Central Government Health-Care and Veterinary Services etc.	94S	-	-	-	-	-	-	-	-	-
Other Local Government Services	95K	68	2	-	-	65	2	-	-	-
Other Central Government Services	95S	20	3	-	0	9	8	-	-	-
Water Supply and Sanitary Services	96K	12	-	-	-	12	-	-	-	-
Private Households	PH	4 275	4 064	-	-	211	-	-	-	-

Table A 5: Process CO_2 emissions subject to taxation, 1995

CO2 emissions subject to taxation, 1995
Component: CO2
Emission source: Process
Unit: 1000 tonnes

Sector	Nr	All	Petrol car 8
All		19	19
Agriculture	11	-	-
Forestry	12	-	-
Fishing etc.	13	-	-
Fish Farming	14	-	-
Manufacture of Other Consumption Goods	15	-	-
Manufacture of Textiles and Apparel	18	-	-
Preserving and Processing of Fish	21	-	-
Manufacture of Meat and Dairy Products	22	-	-
Manufacture of Wood and Wood Products	26	-	-
Manufacture of Chemical and Mineral Products	27	-	-
Printing and Publishing	28	-	-
Manufacture of Pulp and Paper Articles	34	-	-
Manufacture of Industrial Chemicals	37	-	-
Petroleum Refining	40	-	-
Manufacture of Metals	43	-	-
Manufacture of Metal Products, Machinery and Equipment	45	-	-
Building of Ships	48	-	-
Manufacture of Oil Production Platforms	49	-	-
Construction, excl. Oil Well Drilling	55	-	-
Finance and Insurance	63	-	-
Production and Pipeline Transport of Oil and Gas	64	-	-
Oil and Gas Exploration and Drilling	68	-	-
Production of Electricity	71	-	-
Land Transport etc.	75	12	12
Air Transport etc.	76	-	-
Transport by Railways and Tramways	77	-	-
Coastal and Inland Water Transport	78	-	-
Postal and Telecommunication Services	79	-	-
Wholesale and Retail Trade	81	8	8
Other Private Services	85	-	-
Defence	92S	-	-
Local Government Education	93K	-	-
Central Government Education	93S	-	-
Local Government Health-Care and Veterinary Services	94K	-	-
Central Government Health-Care and Veterinary Services etc.	94S	-	-
Other Local Government Services	95K	-	-
Other Central Government Services	95S	-	-
Water Supply and Sanitary Services	96K	-	-
Private Households	PH	-	-

Table A 6: Total CO_2 emissions subject to taxation, 1995

CO2 emissions subject to taxation, 1995
Component: CO2
Source: All
Unit: 1000 tonnes

Sector	Nr	All	Coal	Coke	Petrol-coke	Natural Gas	Petrol car	Petrol other	Domestic Parafin	Jet Paraffin	Auto-diesel	Marine Fuel	Heating Oil	Special Destillate	Heavy Ind. Oil
			1	2	3	5	8	9	10	11	12	13	14	15	16
All		21 669	108	6	1	7 201	5 236	7	488	309	4 319	809	1 936	566	684
Agriculture	11	464	2	-	-	-	13	-	4	-	315	-	102	25	3
Forestry	12	54	-	-	-	-	4	-	-	-	50	-	-	-	-
Fishing etc.	13	80	-	-	-	-	9	-	-	-	-	-	-	68	3
Fish Farming	14	6	-	-	-	-	2	-	1	-	-	2	1	-	-
Manufacture of Other Consumption Goods	15	212	-	-	-	-	10	-	0	-	48	10	111	12	21
Manufacture of Textiles and Apparel	18	30	-	-	-	-	1	-	-	-	5	1	15	-	9
Preserving and Processing of Fish	21	98	-	-	-	-	0	-	0	-	10	2	12	30	43
Manufacture of Meat and Dairy Products	22	109	-	-	-	-	2	-	0	-	30	6	69	1	1
Manufacture of Wood and Wood Products	26	73	-	-	-	-	1	-	0	-	12	3	39	-	18
Manufacture of Chemical and Mineral Products	27	371	-	-	-	-	4	-	2	-	161	13	103	15	73
Printing and Publishing	28	10	-	-	-	-	4	-	0	-	1	0	4	0	-
Manufacture of Pulp and Paper Articles	34	300	25	-	-	-	1	-	0	-	16	0	5	2	251
Manufacture of Industrial Chemicals	37	196	-	-	-	-	0	-	-	-	16	9	27	23	121
Petroleum Refining	40	54	-	-	-	-	0	-	-	-	11	3	37	1	2
Manufacture of Metals	43	222	-	1	-	-	0	-	1	-	25	6	76	28	85
Manufacture of Metal Products, Machinery and Equipment	45	130	-	0	1	-	4	-	1	-	26	7	81	4	6
Building of Ships	48	16	-	-	-	-	1	-	0	-	3	1	11	-	0
Manufacture of Oil Production Platforms	49	15	-	-	-	-	-	-	0	-	3	1	10	-	1
Construction, excl. Oil Well Drilling	55	484	-	-	-	-	37	-	3	-	352	41	47	4	-
Finance and Insurance	63	46	-	-	-	-	38	-	0	-	-	-	6	3	-
Production and Pipeline Transport of Oil and Gas	64	7 154	-	-	-	7 149	-	-	-	1	-	-	-	-	5
Oil and Gas Exploration and Drilling	68	52	-	-	-	52	-	-	-	-	-	-	-	-	-
Production of Electricity	71	35	-	-	-	-	10	-	0	-	18	-	6	-	1
Land Transport etc.	75	2 609	-	-	-	-	120	-	0	-	2 475	-	14	-	-
Air Transport etc.	76	7	-	-	-	-	-	7	-	-	-	-	-	-	-
Transport by Railways and Tramways	77	109	-	-	-	-	-	-	-	-	103	-	6	-	-
Coastal and Inland Water Transport	78	846	-	-	-	-	-	-	-	-	-	557	-	249	40
Postal and Telecommunication Services	79	119	-	-	-	-	100	-	-	-	13	-	6	0	-
Wholesale and Retail Trade	81	1 177	-	-	-	-	621	-	8	-	253	63	206	25	0
Other Private Services	85	629	72	-	-	-	182	-	5	11	41	-	289	30	1
Defence	92S	452	-	-	-	-	3	-	0	297	32	73	47	-	-
Local Government Education	93K	54	-	-	-	-	-	-	-	-	-	-	52	2	-
Central Government Education	93S	16	-	-	-	-	-	-	-	-	-	-	15	1	-
Local Government Health-Care and Veterinary Services	94K	86	-	-	-	-	-	-	1	-	-	-	82	3	-
Central Government Health-Care and Veterinary Services etc.	94S	8	-	-	-	-	-	-	0	-	-	-	8	0	-
Other Local Government Services	95K	70	-	-	-	-	2	-	-	-	66	2	0	1	-
Other Central Government Services	95S	25	-	-	-	-	3	-	-	0	10	8	4	0	-
Water Supply and Sanitary Services	96K	27	-	-	-	-	-	-	-	-	12	-	15	-	-
Private Households	PH	5 221	10	5	-	-	4 064	-	462	-	211	-	430	39	0

Table A 7: Stationary CO_2 emissions exempted to taxation, 1995

CO2 emissions exempted from taxation 1995
Component: CO2
Emission source: Stationary
Unit: 1000 tonnes

Sector	Nr	All	Coal	Coke	Petrol-coke	Natural Gas	Other Gas	LPG	Marine Fuel	Heating Oil	Special Destillate	Heavy Ind. Oil	Crude Oil	Waste	Special Waste
			1	2	3	5	6	7	13	14	15	16	17	18	23
All		4 695	481	43	31	667	2 147	298	372	17	32	294	55	116	143
Agriculture	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forestry	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fishing etc.	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fish Farming	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manufacture of Other Consumption Goods	15	8	-	-	-	-	-	8	-	-	-	-	-	-	-
Manufacture of Textiles and Apparel	18	1	-	-	-	-	-	1	-	-	-	-	-	-	-
Preserving and Processing of Fish	21	102	-	-	-	-	-	17	-	12	30	43	-	-	-
Manufacture of Meat and Dairy Products	22	19	-	-	-	-	-	19	-	-	-	-	-	-	-
Manufacture of Wood and Wood Products	26	0	-	-	-	-	-	0	-	-	-	-	-	-	-
Manufacture of Chemical and Mineral Products	27	744	481	43	31	-	-	90	-	-	-	-	-	-	98
Printing and Publishing	28	14	-	-	-	-	-	14	-	-	-	-	-	-	-
Manufacture of Pulp and Paper Articles	34	281	-	-	-	-	-	9	-	5	2	251	-	-	14
Manufacture of Industrial Chemicals	37	461	-	-	-	-	461	0	-	-	-	-	-	-	-
Petroleum Refining	40	1 683	-	-	-	-	1 659	23	-	-	-	-	-	-	1
Manufacture of Metals	43	84	-	-	-	32	26	22	-	-	-	-	-	-	4
Manufacture of Metal Products, Machinery and Equipment	45	65	-	-	-	-	-	41	-	-	-	-	-	-	24
Building of Ships	48	5	-	-	-	-	-	5	-	-	-	-	-	-	-
Manufacture of Oil Production Platforms	49	5	-	-	-	-	-	5	-	-	-	-	-	-	-
Construction, excl. Oil Well Drilling	55	35	-	-	-	-	-	35	-	-	-	-	-	-	-
Finance and Insurance	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Production and Pipeline Transport of Oil and Gas	64	1 008	-	-	-	635	-	-	372	-	-	-	-	-	-
Oil and Gas Exploration and Drilling	68	55	-	-	-	-	-	-	-	-	-	-	55	-	-
Production of Electricity	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land Transport etc.	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Air Transport etc.	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transport by Railways and Tramways	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coastal and Inland Water Transport	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Postal and Telecommunication Services	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wholesale and Retail Trade	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Private Services	85	116	-	-	-	-	-	-	-	-	-	-	-	116	-
Defence	92S	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Local Government Education	93K	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Central Government Education	93S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Government Health-Care and Veterinary Services	94K	0	-	-	-	-	-	-	-	-	-	-	-	0	-
Central Government Health-Care and Veterinary Services etc.	94S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Local Government Services	95K	1	-	-	-	-	1	-	-	-	-	-	-	-	-
Other Central Government Services	95S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Supply and Sanitary Services	96K	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Private Households	PH	9	-	-	-	-	-	9	-	-	-	-	-	-	-

Table A 8: Mobile CO_2 emissions exempted to taxation, 1995

CO2 emissions exempted from taxation 1995
Component: CO2
Emission source: Mobile
Unit: 1000 tonnes

Sector	Nr	All	Jet Paraffin 11	Marine Fuel 13
All		3 724	1 302	2 422
Agriculture	11	-	-	-
Forestry	12	-	-	-
Fishing etc.	13	1 243	-	1 243
Fish Farming	14	-	-	-
Manufacture of Other Consumption Goods	15	-	-	-
Manufacture of Textiles and Apparel	18	-	-	-
Preserving and Processing of Fish	21	-	-	-
Manufacture of Meat and Dairy Products	22	-	-	-
Manufacture of Wood and Wood Products	26	-	-	-
Manufacture of Chemical and Mineral Products	27	-	-	-
Printing and Publishing	28	-	-	-
Manufacture of Pulp and Paper Articles	34	-	-	-
Manufacture of Industrial Chemicals	37	-	-	-
Petroleum Refining	40	-	-	-
Manufacture of Metals	43	-	-	-
Manufacture of Metal Products, Machinery and Equipment	45	-	-	-
Building of Ships	48	-	-	-
Manufacture of Oil Production Platforms	49	-	-	-
Construction, excl. Oil Well Drilling	55	-	-	-
Finance and Insurance	63	-	-	-
Production and Pipeline Transport of Oil and Gas	64	511	-	511
Oil and Gas Exploration and Drilling	68	190	-	190
Production of Electricity	71	-	-	-
Land Transport etc.	75	-	-	-
Air Transport etc.	76	1 302	1 302	-
Transport by Railways and Tramways	77	-	-	-
Coastal and Inland Water Transport	78	478	-	478
Postal and Telecommunication Services	79	-	-	-
Wholesale and Retail Trade	81	-	-	-
Other Private Services	85	-	-	-
Defence	92S	-	-	-
Local Government Education	93K	-	-	-
Central Government Education	93S	-	-	-
Local Government Health-Care and Veterinary Services	94K	-	-	-
Central Government Health-Care and Veterinary Services etc.	94S	-	-	-
Other Local Government Services	95K	-	-	-
Other Central Government Services	95S	-	-	-
Water Supply and Sanitary Services	96K	-	-	-
Private Households	PH	-	-	-

Table A 9: Process CO_2 emissions exempted to taxation, 1995

CO2 emissions exempted from taxation 1995
Component: CO2
Emission source: Process
Unit: 1000 tonnes

Sector	Nr	All	Coal	Coke	Petrol-coke	Natural Gas	Other Gas	Crude Oil	Waste	N-com-pounds	Ca-com-pounds	Dissol vents	Ore
			1	2	3	5	6	17	18	19	20	21	22
All		8 035	2 949	1 574	563	44	2	687	6	897	1 043	135	136
Agriculture	11	172	-	-	-	-	-	-	-	-	170	2	-
Forestry	12	-	-	-	-	-	-	-	-	-	-	-	-
Fishing etc.	13	13	-	-	-	-	-	-	-	-	13	-	-
Fish Farming	14	-	-	-	-	-	-	-	-	-	-	-	-
Manufacture of Other Consumption Goods	15	-	-	-	-	-	-	-	-	-	-	-	-
Manufacture of Textiles and Apparel	18	0	-	-	-	-	-	-	-	-	-	0	-
Preserving and Processing of Fish	21	-	-	-	-	-	-	-	-	-	-	-	-
Manufacture of Meat and Dairy Products	22	-	-	-	-	-	-	-	-	-	-	-	-
Manufacture of Wood and Wood Products	26	3	-	-	-	-	-	-	-	-	-	3	-
Manufacture of Chemical and Mineral Products	27	878	11	-	-	-	-	-	-	-	841	26	-
Printing and Publishing	28	19	-	-	-	-	-	-	-	-	-	19	-
Manufacture of Pulp and Paper Articles	34	0	-	-	-	-	-	-	-	-	-	0	-
Manufacture of Industrial Chemicals	37	1 873	491	102	376	-	2	-	-	897	-	5	-
Petroleum Refining	40	55	-	-	-	-	-	55	-	-	-	0	-
Manufacture of Metals	43	4 242	2 446	1 472	187	-	-	-	-	-	-	0	136
Manufacture of Metal Products, Machinery and Equipment	45	3	-	-	-	-	-	-	-	-	-	3	-
Building of Ships	48	2	-	-	-	-	-	-	-	-	-	2	-
Manufacture of Oil Production Platforms	49	-	-	-	-	-	-	-	-	-	-	-	-
Construction, excl. Oil Well Drilling	55	35	-	-	-	-	-	-	-	-	-	35	-
Finance and Insurance	63	-	-	-	-	-	-	-	-	-	-	-	-
Production and Pipeline Transport of Oil and Gas	64	675	-	-	-	43	-	631	-	-	-	-	-
Oil and Gas Exploration and Drilling	68	0	-	-	-	0	-	-	-	-	-	-	-
Production of Electricity	71	-	-	-	-	-	-	-	-	-	-	-	-
Land Transport etc.	75	2	-	-	-	-	-	-	-	-	-	2	-
Air Transport etc.	76	3	-	-	-	-	-	-	-	-	-	3	-
Transport by Railways and Tramways	77	-	-	-	-	-	-	-	-	-	-	-	-
Coastal and Inland Water Transport	78	2	-	-	-	-	-	-	-	-	-	2	-
Postal and Telecommunication Services	79	-	-	-	-	-	-	-	-	-	-	-	-
Wholesale and Retail Trade	81	-	-	-	-	-	-	-	-	-	-	-	-
Other Private Services	85	24	-	-	-	-	-	-	-	-	18	6	-
Defence	92S	2	-	-	-	-	-	-	-	-	-	2	-
Local Government Education	93K	-	-	-	-	-	-	-	-	-	-	-	-
Central Government Education	93S	-	-	-	-	-	-	-	-	-	-	-	-
Local Government Health-Care and Veterinary Services	94K	2	-	-	-	-	-	-	-	-	-	2	-
Central Government Health-Care and Veterinary Services etc.	94S	-	-	-	-	-	-	-	-	-	-	-	-
Other Local Government Services	95K	6	-	-	-	-	-	-	6	-	-	-	-
Other Central Government Services	95S	3	-	-	-	-	-	-	-	-	-	3	-
Water Supply and Sanitary Services	96K	-	-	-	-	-	-	-	-	-	-	-	-
Private Households	PH	22	-	-	-	-	-	-	-	-	-	22	-

Table A 10: Total CO_2 emissions exempted to taxation, 1995

CO2 emissions exempted from taxation 1995
Component: CO2
Source: All
Unit: 1000 tonnes

Sector	Nr	All	Coal	Coke	Petrol-coke	Natural Gas	Other Gas	LPG	Jet Paraffin	Marine Fuel	Heating Oil	Special Destillate	Heavy Ind. Oil	Crude Oil	Waste	N-com-pounds	Ca-com-pounds	Dissol vents	Ore	Special Waste
			1	2	3	5	6	7	11	13	14	15	16	17	18	19	20	21	22	23
All		16 454	3 430	1 617	594	711	2 149	298	1 302	2 795	17	32	294	742	122	897	1 043	135	136	143
Agriculture	11	172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	170	2	-	-
Forestry	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fishing etc.	13	1 256	-	-	-	-	-	-	-	1 243	-	-	-	-	-	-	13	-	-	-
Fish Farming	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manufacture of Other Consumption Goods	15	8	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Manufacture of Textiles and Apparel	18	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	0	-	-
Preserving and Processing of Fish	21	102	-	-	-	-	-	17	-	-	12	30	43	-	-	-	-	-	-	-
Manufacture of Meat and Dairy Products	22	19	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-
Manufacture of Wood and Wood Products	26	3	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	3	-	-
Manufacture of Chemical and Mineral Products	27	1 622	492	43	31	-	-	90	-	-	-	-	-	-	-	-	841	26	-	98
Printing and Publishing	28	32	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	19	-	-
Manufacture of Pulp and Paper Articles	34	281	-	-	-	-	-	9	-	-	5	2	251	-	-	-	-	0	-	14
Manufacture of Industrial Chemicals	37	2 334	491	102	376	-	463	0	-	-	-	-	-	-	-	897	-	5	-	-
Petroleum Refining	40	1 738	-	-	-	-	1 659	23	-	-	-	-	-	55	-	-	-	0	-	1
Manufacture of Metals	43	4 325	2 446	1 472	187	32	26	22	-	-	-	-	-	-	-	-	-	0	136	4
Manufacture of Metal Products, Machinery and Equipment	45	68	-	-	-	-	-	41	-	-	-	-	-	-	-	-	-	3	-	24
Building of Ships	48	7	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	2	-	-
Manufacture of Oil Production Platforms	49	5	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Construction, excl. Oil Well Drilling	55	70	-	-	-	-	-	35	-	-	-	-	-	-	-	-	-	35	-	-
Finance and Insurance	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Production and Pipeline Transport of Oil and Gas	64	2 194	-	-	-	679	-	-	-	884	-	-	-	631	-	-	-	-	-	-
Oil and Gas Exploration and Drilling	68	246	-	-	-	0	-	-	-	190	-	-	-	55	-	-	-	-	-	-
Production of Electricity	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land Transport etc.	75	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Air Transport etc.	76	1 305	-	-	-	-	-	-	1 302	-	-	-	-	-	-	-	-	3	-	-
Transport by Railways and Tramways	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coastal and Inland Water Transport	78	479	-	-	-	-	-	-	-	478	-	-	-	-	-	-	-	2	-	-
Postal and Telecommunication Services	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wholesale and Retail Trade	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Private Services	85	139	-	-	-	-	-	-	-	-	-	-	-	-	116	-	18	6	-	-
Defence	92S	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1
Local Government Education	93K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Central Government Education	93S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Government Health-Care and Veterinary Services	94K	2	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	2	-	-
Central Government Health-Care and Veterinary Services etc.	94S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Local Government Services	95K	7	-	-	-	-	1	-	-	-	-	-	-	-	6	-	-	-	-	-
Other Central Government Services	95S	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Water Supply and Sanitary Services	96K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Private Households	PH	31	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	22	-	-

This is CICERO

CICERO was established by the Norwegian government in April 1990 as a non-profit organization associated with the University of Oslo.

The research concentrates on:

- International negotiations on climate agreements. The themes of the negotiations are distribution of costs and benefits, information and institutions.
- Global climate and regional environment effects in developing and industrialized countries. Integrated assessments include sustainable energy use and production, and optimal environmental and resource management.
- Indirect effects of emissions and feedback mechanisms in the climate system as a result of chemical processes in the atmosphere.

Contact details:

CICERO
P.O. Box. 1129 Blindern
N-0317 OSLO
NORWAY

Telephone: +47 22 85 87 50
Fax: +47 22 85 87 51
Web: www.cicero.uio.no
E-mail: admin@cicero.uio.no