On the economic significance of an energy/CO2 tax for the Netherlands

Kamminga, C.; van der Straaten, J.

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Cor Kamminga
Jan van der Straaten

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Abstract

With regard to the economic consequences of substantial measures directed at the conservation of natural resources, such as a substantial energy/CO_2 tax, the discussion is most often limited to the determination of the economic costs. These costs are recognized as the effects the implementation of such measures has on the traditional goals of economic policy such as GDP, the level of employment, and the distribution of income. In this article we argue, however, that the economic consequences should rather be dealt with in a more comprehensive way including both economic costs and economic benefits. For this reason we introduce the economic significance concept. The term 'economic significance' consists of three (nested) levels. First, it contains the traditional economic costs. This level is called the *distributional issue*. Second, by incorporating technology the distributional issue is surrounded by the *structural issue*. In this way possible economic benefits of substantial natural resource-saving measures at the supply-side of the economy are distinguished. The third level, surrounding both the structural and the distributional issue, is labelled the *institutional issue*. At this level the focus is on the role of institutions toward both the other two issues.

In this article we will illustrate the economic significance concept from a substantial energy/CO_2-tax based on both the CO_2 emissions in kg/GJ per energy carrier and the price of renewable energy. Concerning the economic significance of this tax the reimbursement of the revenues is important. We direct attention to the return of these revenues to the economy by means of R&D and investment subsidies. We argue that the introduction of the energy/CO_2-tax on the one hand and the reimbursement of the tax revenues by means of R&D and investment subsidies on the other hand change the selection environment for the process of technical change. This concerns both the adaptation of energy efficiency improvements by individual firms and the change of the energy supply system from a system based on fossil energy carriers to one based on renewables. In principle, the institutional issues that have to be taken into account when dealing with the implementation of the energy/CO_2-tax cannot be defined exactly. Nevertheless, however, the proposals on fossil energy taxation as they have been presented in the Netherlands so far offer some insights into the complexities of the problem.

1. Introduction

Ecologically sustainable development requires a reduction of fossil energy use combined with the increasing application of renewable energy sources. In order to accomplish the transition process from fossil energy to renewables, adequate stocks of fossil energy reserves are needed (Biesiot and Mulder, 1994; Noorman et al., 1996).[1] These stocks have to be extracted from present production and consumption processes. There is therefore a strong need for fossil energy conservation, a need that is strengthened even further if one takes the environmental problems associated with fossil energy use into account as well. This in particular concerns problems related to CO_2 emissions. Anthropogenic CO_2 emissions are considered to give rise to nearly half of the 'enhanced greenhouse effect' contributing to global climate change. Since the Industrial Revolution the atmospheric concentration of CO_2 has increased from about 280 ppmv to approximately 355 ppmv in 1990. About 80% of this increase has been caused by the combustion of fossil energy (Mulder, 1995).

To bring about the necessary conservation of fossil energy, or fossil energy saving, three types of instruments can be deployed: regulatory instruments, economic instruments, and persuasive instruments. Although toward natural resources in general the first type of instrument is still used most in international policy, the ideas about the most adequate policy strategy have changed considerably over the last 10-15 years (Van den Bergh, 1996). Consequently, the interest in economic instruments has grown rapidly, in particular for reasons of efficiency (see e.g. Bohm and Russel (1985), Baumol and Oates (1988), Pearce and Turner (1990), Cumberland (1994), Fankhauser (1995)). In addition, other potential merits of economic instruments include effectiveness and flexibility (Van den Bergh, 1996). Although these are powerful aspects, some authors have pointed out some disadvantages of economic instruments as well (see e.g. Dietz and Van der Straaten (1992), Cumberland (1994), Van den Bergh (1996)).

In the field of fossil energy saving, taxes, subsidies, and tradable permits appear to be the most relevant economic instruments. Against subsidies, however, various authors have raised some rather severe objections (see e.g. Siebert (1987), Baumol and Oates (1988), Bovenberg (1993)). Moreover, so far the concept of tradable permits has in practice been limited to emissions (Von Weizsäcker and Jesinghaus, 1992). In this article we therefore consider taxes the most adequate instrument toward curbing fossil energy use. This is because in our view the need for considerably lower CO_2 emissions is a major reason for stressing the necessity to conserve fossil energy rather than a goal in its own right.

In (neoclassical) economic modelling taxes on fossil energy are generally considered

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The notion that large amounts of non-renewable fossil energy are needed to accomplish a transition to a society based on renewable, non-fossil energy has already been mentioned by Georgescu-Roegen. *`By using these resources too quickly, man throws away that part of solar energy that will still be reaching the earth for a long time after he has departed'* (Georgescu-Roegen, 1971: 21).

'distortions' incurring costs (Repetto et al., 1992; Ekins, 1995). Their economic consequences are therefore regarded as negative. In a neoclassical context the introduction of a 'distortionary' tax on fossil energy only leads to a worsening economic performance in period t=1 compared to the base period t=0 in which it is assumed that no distortions exist. However, the base period cannot be considered as such due to factors like negative externalities arising from the excessive use of fossil energy among other things. Therefore, taxes on fossil energy should not be regarded as a distortion; they rather correct one (Pearce, 1991).

This article addresses the economic significance of a substantial energy/CO_2 tax for the Netherlands under the assumption that the revenues of the tax are reimbursed by means of R&D and investment subsidies. On the basis of this overall objective three research questions can be formulated: 1)What is meant by 'a substantial energy/CO_2 tax'?, 2)What is meant by 'economic significance'? 3)What is the economic significance of the substantial energy/CO_2 tax for the Netherlands when its revenues are reimbursed by means of R&D and investment subsidies? Section 2 briefly deals with the first research question. Next, Section 3 addresses the economic significance concept in 3.1. This section then proceeds to explore the economic significance of the energy/CO_2 tax in terms of what are called "the structural issue" and "the institutional issue" successively. Section 4, finally, contains some conclusions.

2. Fossil energy taxation

In essence, at least from a welfare economics point of view, a tax on fossil energy is supposed to correct the negative externalities resulting from its use. Perfect insight in the damage caused by fossil energy use, in the context of this article related to the emission of CO_2, is therefore indispensable. The generated knowledge about this damage must subsequently be expressed in market prices. In this way it becomes possible to express the damage in $ per ton of carbon (the IPCC estimates the marginal damage of a doubling of CO_2 concentrations at $5-$125 per ton of carbon emitted now (IPCC, 1996)). This way of reasoning may be theoretically correct; it can be doubted, however, whether the damage from CO_2 emissions can seriously be expressed in monetary terms (cf. Dietz and Van der Straaten (1992), Fankhauser (1995)). Hence, rather than to base a fossil energy tax level on damage estimates, it may be more useful to determine it according to other considerations, for instance ecological. This in fact implies the determination of a CO_2 emission target at which the chances on the occurrence of drastic consequences of global climate chance are minimized. Such an approach most often stresses the necessity of substantial reductions in CO_2 emissions. To make such reductions a tax level of $100-$400 per ton of carbon is generally proposed, see for instance Broero et al. (1991) as quoted in Ekins (1995: 293). However, this approach is not very satisfactory either, since the relation between the emission of CO_2 and global climate change is still subject to fundamental questions. We therefore propose another way of determining an adequate fossil energy tax level (the energy/CO_2 tax hereafter) in this article. In doing so we start from the two major reasons for energy conservation discussed in the previous section: 1) the stock of fossil fuel reserves necessary for the transition process from fossil energy to renewables and 2) the required substantial reduction of CO_2 emissions. With regard to the first reason we consider an estimation of the cost price of renewable energy to be important, towards the second reason we consider the CO_2 emissions per energy carrier of interest.

Based on both the cost price of renewable energy and the CO_2 emissions per energy carrier, we first derive the ecologically desirable price level **P** per energy carrier **i** as follows:

Formula 1

$$P_i \quad (EF_i/EF_{ave,t_0}) \quad P_{ren}$$

where
EF_i = the CO_2 emission factor in kg per GJ per energy carrier **i**
$EF_{ave,to}$ = the average CO_2 emission factor in kg per GJ based on both total fossil energy use and total CO_2 emissions in year t_0 [2]
P_{ren} = the price level of renewable energy

For t_0=1990 table 1 shows the ecologically desirable price level per energy carrier. We have calculated the various price levels on the basis of the CO_2 emission factors in kg/GJ (EF_i) shown in the appendix (Nieuwlaar, 1992; Wilting, 1996), an EF_{ave} of 67.4 kg/GJ (Wilting, 1996), and a P_{ren} of Dfl. 15/GJ (Becht, 1989). In addition, table 1 shows the real price level in 1990 (for an explanation of the real price level, see the appendix).

In this article we base the average CO_2 emission factor EF_{ave} on one year, i.e., t_0. Another possibility is to base EF_{ave} on a multi-year period. This might lead to (slightly) different results as far as the ecologically desirable price levels for the various energy carriers are concerned.

Table 1
The ecologically desirable price level per energy carrier and the real price level in 1990

Energy carrier	Ecologically desirable price level in Dfl./GJ	Real price level in Dfl./GJ
Coal	23.41	3.34
Coal products	29.58	3.97
Mineral oil	17.05	7.21
Mineral oil products	17.49	7.81
Natural gas	12.57	7.53
Electricity	46.69	23.33

From table 1 the level of the energy/CO_2 tax **T** per energy carrier **i** can subsequently be derived as follows:

Formula 2

$$T_i \quad ((P_{i,1990} \quad P_{r,1990})/P_{r,1990}) \quad 100$$

where
$P_{i,\,1990}$ = the ecologically desirable price level in 1990 per energy carrier **i**
$P_{r,\,1990}$ = the real price level in 1990 per energy carrier **i**

For the various energy carriers table 2 then shows the level of the energy/CO_2 tax.

Table 2
The level of the energy/CO_2 tax

Energy carrier	The energy/CO_2 tax
Coal	601%
Coal products	645%
Mineral oil	136%
Mineral oil products	124%
Natural gas	67%
Electricity	100%

3. The economic significance of the energy/co$_2$ tax for The Netherlands

3.1 Introduction

Before we go into the economic significance of the energy/CO_2 tax for the Netherlands on the basis of what we call the economic significance concept, we first want to make the following assumptions toward this tax explicit. First, corresponding to the introduction of the tax in the Netherlands, a similar energy/CO_2 tax is introduced in the other countries of the European Union. Second, the tax is introduced gradually. Its end-level is reached around 2015. Third, in the early part of the introduction route a relatively small part of the tax is effectuated. In this way we expect the possibilities for strategic adaptation processes at the level of the individual firm to be maximized.

Toward the reimbursement of the tax revenues we further assume the following. Based on the use of fossil energy in the Netherlands in 1990, total gross tax revenues will be about Dfl. 24 billion. These proceeds have to be corrected for the level of fossil energy conservation realized through the introduction of the tax, however. Our target is for the tax to reduce energy use from the 1990 level of 150 GJ/per capita, derived from total energy use corrected for the balance of energy imports and exports, to 105 GJ/per capita in 2015.[3] This means a reduction of about 30% in 2015 compared to 1990. As a result, total net proceeds can be estimated at approximately Dfl. 17 billion. In contrast to the currently common view that these revenues can be used to reduce distortionary taxes on labor, see for instance Bovenberg (1994), we suppose in this article that they are reimbursed by means of R&D and investment subsidies directed at fossil energy saving. Although as a stand-alone policy instrument such subsidies are in general considered rather ineffective in promoting R&D and investment in natural resource-saving technologies (see for example Vermeulen (1992), Kemp (1995)), a combination with taxes might lead to a much better result, compare Kemp (1995).

3.2 The economic significance concept

The economic significance concept used in this article was first introduced in the SCAN project (Kamminga et al., 1995; Moll and Biesiot, 1995).[4] In this concept the underly-

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This seems to be a reasonable intermediate goal in the process of realizing a situation in the second half of the next century in which energy is completely supplied through renewable sources and requirements from a viewpoint of both intra- and inter-generational equity (in terms of the access to the energy services needed to satisfy at a comfortable level the requirements for food, housing, lighting, transportation etc.) are met as well. Such a situation may be characterized by an annual energy use of about 50 GJ/per capita. In this respect, see for instance Mulder (1995).

The full name of the SCAN project is: `Analysis of the social significance, acceptability, and feasibility of long-term low-energy/low-CO_2 scenarios for The Netherlands'. The project was executed as part of the Dutch National Research Program on Global Air Pollution and Climate Change.

ing idea is that substantial measures directed at the conservation of natural resources[5], such as the energy/CO_2 tax described above, might have both negative and positive economic consequences. This strongly depends on the institutional context and the extent to which this context can be changed. Three nested economic significance levels are therefore distinguished. The first level addresses the distortionary impact of a measure on the economy. In this respect, one can think of possibly negative consequences on traditional goals of economic policy such as an equitable distribution of income, full employment, and economic growth. This negative economic impact can be compensated for, however, if we consider some countervailing considerations. In the case of the energy/CO_2 tax such considerations include the reimbursement of the tax revenues and technical change, among other things, compare Ekins (1995). The explicit recognition of factors like these lead to the second economic significance level. At this level the central element is 'technical change'. Through the introduction of a substantial measure aimed at natural resource conservation, technical change can be stimulated by which the production structure changes in a natural resource-saving direction. Finally, at the third economic significance level it is recognized that toward the other two levels institutional adaptations are involved or required. 'Institutional change' is therefore the central element at this level. Figure 1 shows the three economic significance levels.

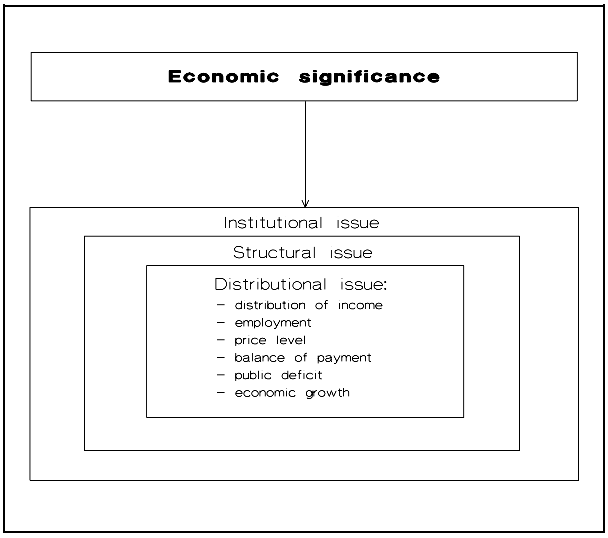

Figure 1 The three economic significance levels: the distributional issue, the structural issue, and the institutional issue [Kamminga et al., 1995]

In this respect, natural resources both encompass all kinds of renewable and non-renewable materials that can be won from nature (plants, animals, minerals and fossil energy) and present buffering natural processes which can be interpreted as stocks of environmental goods, cf. Dietz and Van der Straaten (1992).

In this figure the first level is called the distributional issue, the second the structural issue, and the third the institutional issue. In relation to the economic significance of the energy/CO_2 tax for the Netherlands, we will first discuss the structural issue in section 3.3. Subsequently, we will address the institutional issue in section 3.4. In this article we will not go into the distributional issue explicitly, although this issue will be considered in the context of the institutional issue in section 3.4.

3.3 The economic significance of the energy/CO_2 tax for the Netherlands: the structural issue

At the level of the structural issue the process of technical change on the supply side of the Dutch economy is addressed.

The supply side of the Dutch economy is characterized by a huge emphasis on very energy-intensive parts of the agro-industrial complex, on the both capital- and energy-intensive processing industry, and on international commercial services which are getting more and more energy-intensive, see for instance Van Zanden and Griffiths (1989), Centraal Plan Bureau (1992). Over the 1970-1988 period five economic sectors, that is, chemical (basic products) industry, basic metal industry, freight transport, greenhouse horticulture, and food and stimulant industry, accounted for approximately 45% of direct energy use in the Netherlands (Kamminga et al., 1995). Over the same period their direct contribution to the Dutch economic performance in terms of GDP and level of employment amounted to 13-14% (Kamminga et al., 1995). With respect to these last figures it should be explicitly recognized, however, that a large part of the other sectors in the Dutch economy, such as trade, banking, insurance and business services, is complementary to the agro-industrial complex and the processing industry. It must therefore be concluded that the economic importance of the five energy-intensive sectors mentioned above is much higher than the direct contribution in terms of GDP and employment suggests.

Because of the huge emphasis on fossil energy-intensive types of industry, sustainable development requires a rather radical adaptation of the Dutch economy. Such an adaptation is also an economic necessity, however. The fact is, it is often argued that the economic prospects of both the agro-industrial complex and the processing industry are not very bright, see for example Centraal Plan Bureau (1992). Their different kinds of products have above all rather low prices which causes Dutch export to be extremely vulnerable to international competition. In the long run this does not look good, especially with regard to competition from low-wages countries.

In the adaptation process of the Dutch economy an important role is played by technical change. Roughly speaking, technical change consists of two stages.[6] In the first stage

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Derived from Kemp et al. (1994). Kemp et al. distinguish two phases in each of these two stages; i.e., four phases in total.

the focus is on research and development. During this stage the entire process of technical change starts with scientific and technical research. The main purpose of this research is the accomplishment of inventions. Some of these inventions are subsequently further developed until the moment that they are ready for market introduction. Then the second stage can be reached, the stage of innovation and diffusion. Innovation implies the first commercial application of a new technology - whether it is a new product, a new process, or even a new system, whereas diffusion refers to its adaptation and its use over time.

The revenues of the energy/CO_2 tax described in section 2 can well be used to stimulate both stages of the process of technical change. The technical energy conservation potentials from De Beer et al. (1994) can illustrate this. Based on these potentials, energy use in the Netherlands can be reduced by more than 50% in 2015 compared to 1990 through improvements in energy efficiency under the assumption that both production structures and consumption patterns remain unchanged (Wilting, 1996). However, this does not take into account the effects of the growth of the Gross Domestic Product, the volume of private consumption, imports, exports, and population. Following the various annual growth rates as presented in the European Renaissance scenario of the Dutch Central Planning Bureau (Centraal Plan Bureau, 1992), the improvements in energy efficiency will reduce energy use per capita by approximately 14% in 2015 compared to 1990. This implies a reduction from 150 GJ/per capita to 129 GJ/per capita. On the one hand, this should be considered the maximum reduction that is achievable when all the efficiency improvements suggested by De Beer et al. (1994) are implemented. Conversely, it is the minimal potential since new technologies may arise within the next twenty years.

The energy/CO_2 tax and the reimbursement of its revenues through R&D and investment subsidies can contribute to both the implementation of the presently known technical potential for energy conservation and the research aimed at the development of new technologies.[7] Its substantial level and the destination of the proceeds imply a significant change of the *selection environment* of both firms which are to adopt innovations and firms which aim at the invention and development of new technologies. The *selection environment* in this respect comprises the entire set of actors, structures, and institutions influencing the selection process (Mol, 1991). Economic factors are among its important dimensions, see also for instance Nelson and Winter (1982).

In the case of innovation and diffusion, it is often observed that although at current energy prices many energy efficiency improving techniques are already economically profitable, they are hardly applied in Dutch industry. From the point of view of the individual firm important economic reasons for this lagging level of penetration include (Van der Werff and Opschoor, 1992; Gillissen et al., 1995)

It is stressed expressly that here we only pay attention to economic factors influencing research and development activities, innovation, and diffusion. Furthermore, also other factors, such as a lack of knowledge and the existing institutional infrastructure, influence these kind of economic initiatives.

- low energy costs, both absolutely and relatively as a percentage of total operating cost,
- uncertainty about future energy prices, and
- a lack of capital.

Of these three reasons the second loses its importance to a certain degree since one of the main characteristics of the energy/CO_2 tax as described in this article is its gradual introduction until 2015. Moreover, the introduction route is clearly defined. So, low energy costs and a lack of capital remain the most important economic barriers for investments in already existing and economically profitable technologies aimed at improving energy efficiency. By means of the energy/CO_2 tax subsidy scheme energy costs are substantially raised, however. Additionally, the investment subsidies resulting from it can provide a substantial part of the amounts of capital necessary for undertaking energy efficiency improving investments. As a consequence, investment patterns may be changed significantly in Dutch industry in favor of the last type of investments.

In terms of both ecological and economic significance, the reimbursement of the tax revenues through R&D subsidies is even more interesting and more important, in particular in the longer run. If in the Netherlands one speaks of a lagging level of technical change compared to other western industrial countries, this conclusion is most commonly based on the measurement of R&D expenditures as a percentage of Gross Domestic Product. Expressed in this way the Netherlands have lost ground over the last 15-20 years, see Lundgren (1995). In combination with the moderate economic prospects of the two main pillars of the Dutch economy, the agro-industrial complex and the processing industry, this is a rather alarming development. One way to reverse this development might be through R&D subsidies financed by means of the revenues from the energy/CO_2 tax. Since these subsidies are directly connected to higher fossil energy prices, R&D efforts may not only be directed at energy efficiency improvement on the demand side but also at the energy supply system which at present is almost entirely based on fossil energy carriers such as coal, oil, and natural gas. Through the tax-subsidy scheme an intensification of the search for and the development of types as well as applications of renewable energy sources can be expected. Examples of such sources in particular include wind energy, solar energy, and biomass. Obviously, this is interesting from an ecological point of view, since sustainable development explicitly requires a switch from fossil energy carriers to renewables. Moreover, in an economic sense this also clearly offers what can be called *first mover advantages*. These advantages result partly from the transformation process of the energy supply system from the present system based on fossil energy carriers to one based on renewable sources of energy. In addition, and perhaps more important, the fundamental switch of the energy supply system can lead to a fundamental change on the energy demand side. Thus, a new *technological paradigm* may occur from which a need for a whole range of new equipment arises (for a short description of the technological paradigm concept, see Dosi and Nelson (1994)). In this respect, one should not only think of technical equipment but also of organizational and institutional tools. In this way we argue that there is no one-sided influence of the *selection environment* on the process of technical change. On the contrary, the process of technical change significantly influences the *selection environment* too.

3.4 The economic significance of the energy/CO_2 tax for the Netherlands: the institutional issue

In principle, it is not possible to define exactly the institutional issues which have to be taken into account when dealing with the implementation of a energy/CO_2 tax as described above. This is in particular caused by the fact that we do not have any experience with the implementation of such a tax. It can be taken for sure, however, that many unexpected and unpredictable reactions of relevant actors will take place during the implementation period. This does not imply, however, that we do not have any insights into the complexities of the problem. In the proposals on fossil energy taxation as they have been presented in the Netherlands previously, two potential frictions can be recognized. First, there is the point of the collection of the tax as such. Normally speaking, the collection of taxes is the responsibility of the Minister of Finance; one should not overlook the point that the revenues of taxes are not given back to citizens or businesses. This implies that there is a substantial institutional problem when energy taxes are proposed. Furthermore, there is the reaction of economic actors not willing to be confronted with higher prices of their inputs. Both problems were recognized in the Netherlands when some years ago similar proposals were done. The discussion of the controversies resulting from these proposals can provide us insight into the relevant institutional complexities.

When the Minster of Environmental intended to present to Parliament the National Environmental Policy Plan at the end of the eighties, a central question was how the NEPP should be financed. The NEPP is partly financed by the government and partly by producers and consumers. Indeed, the greatest part of the plan is financed by producers and consumers, so the amount of money to be spent by the government is not high. Nevertheless, in a situation in which it is political common sense to reduce the influence of the government and to reduce the budget of the state, such an amount is difficult to realize. In line with the historical development a great part of the money needed was found in an increase in the levy on fuel. But it was impossible to get all the money from this source, as this would have caused an increase in the cost price of all industries using a lot of energy. This would have had a negative effect on the volume of exports. So, other sources to finance the plan were necessary.

In the beginning it was not clear how this could be arranged. But the idea of a more important role of a system of levies brought the top of the ministries of Economic Affairs and of Finance to a revolt (Aarden en Van Venetië, 19 January 1989). A second reason for this revolt is found in the assumed macro-economic aspects of these measures. All levies would result in higher costs for exporting industries and would increase the collective burden, as a percentage of GNP. Neither of those effects were desired.

This opinion is based on political priorities as well as on old-fashioned economic paradigms which give priority to certain economic variables such as the export position and the level of income and profits, and which neglect the economic relevance of environmental problems. This strong opposition to the financial aspects of the NEPP in the top of certain ministries hampered the publication of the plan. In the meantime environmental economists became aware of this controversy. They were afraid that the NEPP would be killed before it was born. They sent an open letter to Prime Minister Lubbers and plead for the implementation of financial instruments. They were of the opinion that a sound environmental policy was more important from an economic point of view at this moment than the financial deficit of the state, the collective burden or the purchasing power of the population (Anonymous, 21 March 1989). This letter received a lot of attention in the media, but the political process was going on in the ministries and in the cabinet.

In the cabinet Lubbers-II the controversy about the financial aspects was present too. The Minister of Economic Affairs and the Minister of Finance were of the opinion that the collective burden could not be increased and that an increase in expenses of the state, financing the plan, should be compensated by a decrease in expenditures elsewhere (Anonymous, 11 April 1989). But the balloons went elsewhere. There was a proposal, which was accepted in the cabinet, to abolish the standard tax reduction for commuting costs and to increase the taxes for house-owners. In the beginning there were no problems about these proposals in Parliament. But the grassroots support of the right wing liberal party were dead against these measures. An increase in the levy on fuel, the abolishment of tax reductions for house-owners and commuters was too much for a party of which the majority of the members and voters live in suburban green areas, commuting to their working places in the cities by car and in most cases with a house of their own. The result was that this party came into difficulties, as the Minister of Environmental Affairs and the Minister of Transport, being members of the same liberal party, were politically responsible for the NEPP. Especially the Minister of Environment was a great advocate of this plan, including the implementation of important levies with the aim to reduce polluting emissions by creating a higher price for these activities (Van Roessel and Van Venetië, 27 April 1989).

It became clearer that the right wing liberal party would not accept the proposed implementation of the financial instruments and that the Minister of Environmental Affairs and those of Transport would draw a lucky number to the NEPP (Aarden, 1 May 1989). The Organization of Dutch Employers supported the party in its resistance against the plan. They were of the opinion that this environmental problem was worth the fall of the government (Anonymous, 1 May 1989). The result could be predicted, indeed, the fall of the government (Aarden, 3 May 1989). Due to the fact that the Ministers of Environment and Transport were the great advocates of the NEPP, their position in the party became untenable. Some weeks after the government's fall the NEPP was presented in Parliament. There were elections and a new cabinet was composed. The new coalition partner of the Christian Democrats was the Social Democratic Party. The new Minister of Environmental Affairs is a member of this party.[8] The NEPP became the starting point of this new cabinet: Lubbers-III. Later on a revised version of the NEPP was accepted by Parliament: the NEPP-Plus. This version contains hardly any new elements.

This political struggle makes it clear that a substantial rise in revenues from environmental measures can cause many political difficulties, due to the fact that these measures are always accompanied by shifts in power in the state machinery, while, additionally, these measures have distributional effects. Furthermore, the arguments used are strongly related to traditional neoclassical theory, in which attention is only given to the production factors labor and capital. Even though the production factor natural resources is given some theoretical attention, one may say that neoclassical economic theory in reality deals with labor and capital. Many economic textbooks fill their pages with labor, capital and markets. It may be clear that this is a result of the use of an economic system which has its roots in the last century and which does not have sufficient categories to describe and sufficiently analyze environmental problems.

One should be aware that these theoretical contemplations have everything to do with environmental politics. The production factors labor and capital could 'solve' their controversies by shifting their problems to the environment (and in many cases they are still going on with this process). They can use their position in the state machinery to realize this process. They have used the last hundred years to arrogate the state machinery and important sections of society. The economic importance of the production factor natural resources is hardly recognized and, more importantly, this production factor does not have any political power in the state machinery itself, compared with the production factors labor and capital. It is the environmental groups which have, in some cases, had the countervailing power put pressure on the government (Van der Straaten, 1990). The coherence between traditional economic theory, the balance of power in society, and environmental politics is the main cause of the relatively weak results of the Dutch attempts to implement strict environmental norms and to tax environmentally unfriendly economic activities.

Furthermore, the evaluation of the Dutch policy with regard to the reduction of the enhanced greenhouse effect can provide us with new insights into the institutional frictions in this policy field. The enhanced greenhouse effect as such has been known for many decades. However, the Dutch government did not pay attention to this phenomenon until the publication of the previously mentioned National Environmental Policy Plan of 1989 (Minister of Housing, Regional Development and the Environment et al.,

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It is often assumed, that Social Democratic Parties are better for the environment than others. The history of the NEPP does not confirm these ideas, as the Ministers of Environmental Affairs, preparing the NEPP were members of the right wing liberal party and belonged to the best advocates of the implementation of a sound environmental policy. The role of the Social Democratic Party and the present social democratic Minister of Environmental Affairs can be derived from the way the minister is portrayed in a popular Dutch TV program, which is a kind of Dutch version of the British program Spitting Image.

1989). This plan is aimed at levelling off carbon dioxide emissions: in the year 2000 the emissions should be at the same level as in 1989/1990; in a later plan, the NEPP-Plus, it was stated that a 3-5 per cent reduction of emissions has to be reached in the year 2000 taking 1990 as a basis. Before 1989, the enhanced greenhouse effect was not an issue in the Netherlands. This can be demonstrated by the negotiations at the end of the 1980s regarding the reduction of the nitrogen oxide emissions by motor cars, the Netherlands advocated the introduction of a catalytic converter which would increase the use of gasoline by 10 per cent. This implies that such a converter would increase the enhanced greenhouse effect. Another option, the lean-burnt engine, would result in a mild reduction of acidifying substances, but in a considerable reduction of the emission of carbon dioxide (Dietz, Van der Straaten and Van der Velde, 1990). This option was not given serious attention.

As was stated previously, the enhanced greenhouse effect is mainly caused by the use of fossil fuels. Some fuels such as natural gas has a lower percentage of carbon than coal. Thus, the substitution of resources can result in a lower emission of carbon dioxide. The most significant contribution to lowering emissions can be obtained by using less energy. This implies that the actors involved be those sectors having a high consumption of energy. As has been stated the enhanced greenhouse effect is a global problem. The Dutch sectors responsible for the emissions can be treated without paying attention to these global problems. All emitting sectors are in the same position. They have to lower their consumption of energy.

In this policy area, there was one topic which was the focus of attention after 1989, namely the introduction of an energy tax. It was argued that the current price of energy was too low. This low price resulted in a relatively high consumption of energy. The implementation of an energy tax was seen as an instrument bringing prices to a more appropriate level.

Debate began in earnest in 1991 when it became clear that the Minister of Environmental Affairs intended to increase the levies on energy consumption. In 1991, the total amount of this levy was 1 billion guilders, and the intention was to increase the levies to 2.5 billion guilders in 1995. These levies were seen as a source of revenue for the Ministry of the Environment. Employer organizations and the large corporations were against such an increase. They were afraid that there would be a strong tendency to increase these levies every year (Marieke Aarden, 19 September 1991). However, this levy was not considered as a regulating levy in order to lower energy consumption. The aim of the levy was to finance the Ministry of the Environment.

The increase in the price of energy was sharply criticized by seven international companies which were large consumers of energy such as AKZO, Shell and DSM. These companies wrote a letter to the Minister of Economic Affairs in which they stated that they would shift their investments to other countries in the case of an increase in the price of energy. The right wing liberal party sided with these companies (Anonymous, 23 September 1991). However, some points were not given sufficient attention. In the first place, it has always been the intention of the Dutch government to implement an energy tax in cooperation with the other European countries. In the second place, the prices of energy for industrial purposes were the lowest in Europe as can be concluded from figure 2 (Leo Hauben, 19 October 1991).

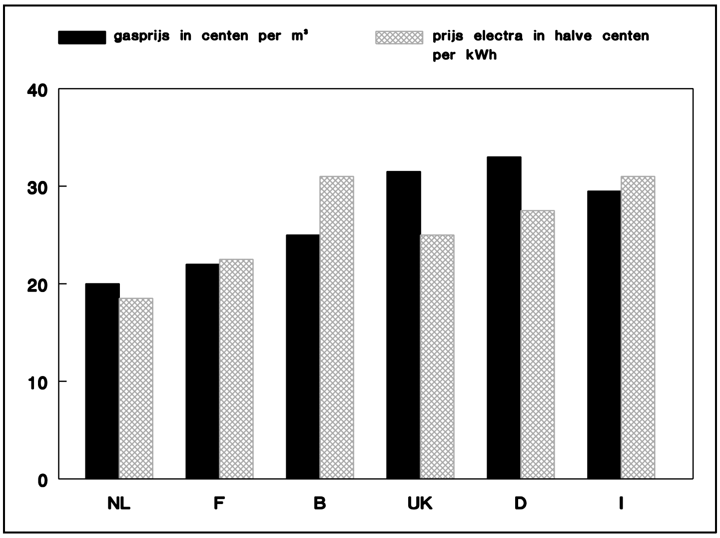

Figure 2 Industrial Energy Prices; the Netherlands compared with five other European countries (derived from Hauben, 1991)
Gasprijs in centen per m^3 = Gas price in cents per m^3;
Prijs electra in halve centen per kWh = Price of electricity in 0.5 cents per kWh;
NL = the Netherlands; F = France; B = Belgium; UK = United Kingdom; D = Germany; I = Italy

The Minister of Environmental Affairs established the Wolfson Commission which included a number of well-known Dutch economists. The Minister argued that companies working in an international market would probably be exempted from an energy tax (Anonymous, 22 October 1991). In Parliament most parties argued that the concentration of a tax on energy would not be the best way of dealing with environmental problems. It would be better to introduce a tax on the use of all natural resources including manure, groundwater and heavy metals (Anonymous, 23 October 1991).

At the request of the Wolfson Commission the Central Planning Bureau investigated the effects of the implementation of an energy tax accompanied by a decrease in the taxes on labor. The argument was that a shift of taxes away from the abundant production factor labor in the direction of the use of natural resources would result in a better system of state financing, more in accordance with the relative scarcity of production factors. Several scenarios were calculated by the Central Planning Bureau. It was concluded that in the most favorable scenario the effects on employment would be neutral. In a scenario in which only the Netherlands implemented an energy tax there would be a negative influence on employment figures (Harko van der Hende, 28 January 1992).

These calculations by the Central Planning Bureau were used as an argument by the Minister of Economic Affairs who claimed that these results were so negative that he was dead against the implementation of any energy tax. In Parliament, there was little appreciation on the part of most parties for the opinions of the Minister of Economic Affairs. They argued that the Minister should have waited until the publication of the Wolfson Commission report. Some environmental groups said that, from the political point of view, this behavior on the part of a minister was unacceptable. Of course, the international Dutch companies used the opinion of the Minister of Economic Affairs as a support of their case (Anonymous, 31 January 1992).

The Wolfson Commission came to the conclusion that the Cabinet was divided on the implementation of an energy tax. Therefore, they refused to continue their work (Anonymous, 1 February 1992). During a discussion with the Cabinet the commission decided to publish their results in due time. These results lead to many controversies. The assumptions in the model the Central Plan Bureau used were criticized by many environmental groups. However, it can be said that the publication of the opinion of the Minister of Economic Affairs before the publication of the report had changed the political climate in such a way, that from the political perspective these publications could be neglected. The implementation of an energy tax had become, by the Minister's statements a political non-issue (Marieke Aarden and Harko van der Hende, 20 February 1992). The influence of the seven international companies mentioned previously have had sufficient effect on the political debate that an energy tax could no longer be realized in the Cabinet and in Parliament (Marieke Aarden and Harko van der Hende, 18 February 1992).

After the publication of the report of the Wolfson Commission report and the resulting political debate no plans were developed to implement a substantial energy tax. One of the most significant instruments which could be used to reduce energy consumption had become a non-issue in the Netherlands.

4. Conclusions

Through both the introduction of a substantial energy/CO_2 tax and the reimbursement of the tax revenues by means of R&D and investment subsidies, the selection environment for the process of technical change changes. First, this concerns the adaptation of innovations toward energy efficiency improvements by individual firms. Second, in terms of research and development this concerns the change of the energy supply system from a system based on fossil energy, the present situation, to one based on renewables. This may lead to a change of the technological paradigm which in turn will considerably influence the energy demand side in terms of technical equipment and organizational and institutional tools. This not only produces a substantial ecological result (the ecological significance) but also contributes to the required economic renewal of the supply side of the Dutch economy.

One important remaining question is, however, whether it is reasonable to assume that the channelling of the tax revenues to R&D and investment subsidies will exhaust the entire revenue. If not, how should the remaining revenues then be returned to the economy?

Regarding the institutional aspects the following conclusions can be drawn:

* New social and institutional arrangements have been realized. However, as soon as environmental problems with the additional distributional effects came up for discussion it became clear that the traditional arrangements where distributional conflicts are normally discussed at the political level did not play a significant role. Additionally, the new arrangements were not appropriate to solve these distributional problems. This resulted in a clear position in which energy taxes could not be implemented

* The behavior of actors clearly demonstrated that they were all aware of the shrinking possibilities to use the environment as a sink. Furthermore, they used these limitations to confront other actors with distributional conflicts.

* In the 1980s the environmental awareness of the population and Parliament went hand in hand. In the nineties this was no longer the case. Parliament gave more attention to traditional economic problems. The fall of the Cabinet-Lubbers II clearly demonstrated that traditional economic issues were given a higher profile.

* New institutions and arrangements did not fulfil a sufficient strong role to make the implementation of an energy tax possible. It can not be seen how this can be realized in the future.

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Appendix

CO_2 emission factors in kg/GJ per energy carrier

Energy carrier	CO_2 emission factor in kg/GJ
Coal	105.2
Coal products	132.9
Mineral oil	76.6
Mineral oil products	78.6
Natural gas	56.5
Electricity	209.8

Explanation of the real price level in 1990 in Dfl./GJ:

(the used conversions in GJ are all derived from (Koninklijke PBNA BV, 1987: 817))

Coal: 1 ton = 29.31 GJ.
In 1990 the price of coal amounted to Dfl. 98/ton (Albers et al., 1993: 11).

Coal products: 1 ton = 28.05 GJ (cokes).
Based on the 1990 price of coal of Dfl. 98/ton the price of coal products has been determined as follows: 98*(1.248/1.097). The latter term reflects the energy needed for the conversion from coal to cokes (Nieuwlaar, 1992: 10). This conversion is supposed to be fully effectuated through the use of coal.

Mineral oil: 1 ton = 41.87 GJ.
In 1990 the price of crude mineral oil amounted to Dfl. 302/ton (Albers et al., 1993: 11).

Mineral oil products: 1 ton = 41.78 GJ (gas-,diesel- and light fuel oil).
Based on the 1990 price of mineral oil of Dfl. 302/ton the price of mineral oil products has been determined as follows: 302*(1.121/1.037). The latter term reflects the energy needed for the conversion from mineral oil to mineral oil products, including distribution (Nieuwlaar, 1992: 10). This conversion is supposed to be fully effectuated through the use of mineral oil.

Natural gas: 1000 m^3 = 31.65 GJ
In 1990 the Gasunie sold 40.3 billion m^3 natural gas in the Netherlands. The corresponding price amounted to Dfl. 9.6 billion (Gasunie, 1990: 10,11,40). The average price was therefore Dfl. 0.2382/m^3 or Dfl. 7.53/GJ.

Electricity: 1 MWh = 3.6 GJ
In 1990 the average price of electricity amounted to Dfl. 0.084/kWh (Samenwerkende Elektricteits Producenten (SEP), 1990: 35) or Dfl. 23.33/GJ.

Cor Kamminga
Center for Energy and Environmental Studies IVEM
University of Groningen
Nijenborgh 4, 9747 AG Groningen, The Netherlands

Jan van der Straaten
European Centre for Nature Conservation
Department of Leisure Studies
Tilburg University
P.O. Box 1352, 5004 BJ Tilburg, The Netherlands