Kyoto Protocol and Beyond: The Economic Cost to the Netherlands

(Prepared for the International Council for Capital Formation)

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FOREWORD

Scope

This study assesses for the Netherlands the ***marginal cost of carbon dioxide[1] abatement accounting for projected changes in other greenhouse gases, and the resulting economic cost.*** While the Kyoto Protocol established limits for participating countries' emissions from six greenhouse gases, this analysis analyzes the cost of reducing carbon dioxide (CO_2) from energy use after taking into account reductions in the other greenhouse gases that were projected by reliable sources. There was no attempt to quantify the cost of these reductions in the analysis.

Sponsor

This study was prepared for the International Council for Capital Formation, although the views expressed are strictly those of the authors.

Contributors

This study was prepared under the direction of Mary H. Novak, Managing Director, Energy Consulting.

[1] While the Kyoto Protocol established limits for participating countries' emissions from six greenhouse gases, this analysis focuses on carbon dioxide (CO_2). The outlook for the other gases is based on forecasts changes in the other greenhouse gases that were not prepared by DRI•WEFA. There was no attempt to quantify the cost of these reductions in the analysis.

Further, the so-called Kyoto Flexible Mechanisms such as Joint Implementation (within Annex B) or the Clean Development Mechanism (outside of Annex B) were not included in this analysis. These measures would allow countries to reduce carbon emissions in other countries through investments in capital or technology. However, the proposals under consideration by the EU Parliament do not allow credit for these mechanisms.

TABLE OF CONTENTS

Executive Summary

In December 1997, the Kyoto Protocol was agreed to by the Conference of the Parties to the Framework Convention on Climate Change. Under this Protocol, the 38 Annex B countries agreed to reduce their greenhouse gas emissions in aggregate to about 5% below 1990 levels for the period 2008–2012. Specific targets were set for each Annex B country with the exception of the European Union countries that agreed to a single group target. Subsequently, the European Union agreed to the quantified targets for each country. The Netherlands agreed to reduce greenhouse gas emissions 5.5% below 1990 emission levels.

Since 1997, more substance has been put onto the skeleton framework of the Kyoto Protocol. Most of the structures for operation of the Protocol are largely in place, including the so-called flexible mechanisms, operation of sinks, and penalties for non-compliance for the first period (2008-12).

While tightened emission limits for subsequent periods have not yet been specified, they have been under discussion. Recent proposals under consideration are:

Case 1: *Current commitment under the Kyoto Protocol through the first period (2008-2012) and a target level of 60% below current (2000) levels of CO_2 emissions by 2050, achieved via a continuous annual reduction per year beyond the first Kyoto commitment period. (For the Netherlands, this results in a target emission rate of 83.5% of 1990 levels in 2020.)*

Case 2: *Current commitment under the Kyoto Protocol through the first period (2008-2012) and a target level of zero CO_2 emissions by 2050 achieved via a continuous annual reduction beyond the first Kyoto commitment period. (For the Netherlands, this results in a target emission rate of 74.5% of 1990 levels in 2020.)*

While advocates push for ratification, most of the Annex B economies are experiencing rising greenhouse gas emissions due to rising population and economic performance.

This study assesses for the cases described above the ***marginal cost of carbon dioxide[2] abatement accounting for projected changes in other greenhouse gases.*** The marginal cost of carbon dioxide abatement is the economic cost of meeting the established targets through domestic measures only. For the purposes of this study, an intra-country tradable permit system is established.

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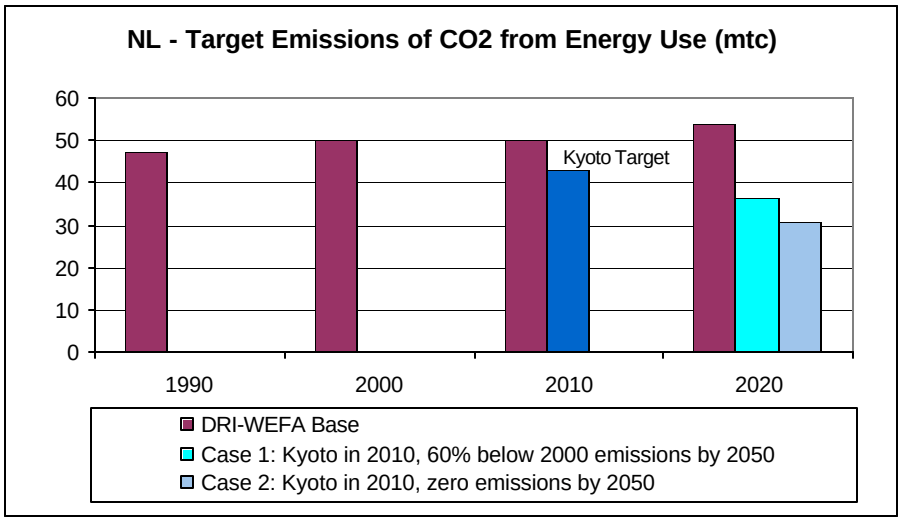
Further, the so-called Kyoto Flexible Mechanisms such as Joint Implementation (within Annex B) or the Clean Development Mechanism (outside of Annex B) were not included in this analysis. These measures would allow countries to reduce carbon emissions in other countries through investments in capital or technology. However, the proposals under consideration by the EU Parliament do not allow credit for these mechanisms.

Under the assumption that the Netherlands agrees to meet and maintain the emission level set by the Kyoto Protocol, the Netherlands would have to reduce emissions 14% by 2010 and 20% by 2020. Under the assumption of further emission restraints in the post-2012 period, the Netherlands would have to reduce its emissions by 33-43%.

Exhibit 1.



This study assesses the ***marginal cost of carbon dioxide abatement assuming the quantified reductions in other gases*** and the economic impact of meeting the current and the two proposed policies described above on the Netherlands.

Under the Kyoto Protocol, the marginal cost of carbon abatement would dramatically increase delivered prices of energy to consumers and businesses in 2010:

- the price of home heating oil would rise by more than 23%.
- gasoline and diesel prices would be 9% and 15% higher, respectively, than the baseline estimates.
- industry would pay 71% more for its natural gas, and electricity prices would rise more than 96% above the baseline estimate.

By 2020, if one of the more stringent targets were implemented, consumers and businesses will be subjected to higher energy prices than anticipated under the Kyoto Protocol.

The economy will suffer from a loss of output as real GDP shrinks 2% below base case levels during the 2008-12 budget period. In 2020, real GDP could be 1.6% to 2.7% BELOW THE BASELINE LEVEL depending on whether Case 1 or Case 2 has to be achieved.

Annual job losses, versus the basecase, could be as high as 0.11 million in 2008-10, and could exceed that level through 2020 if Case 2 targets are implemented.

Exhibit 2.

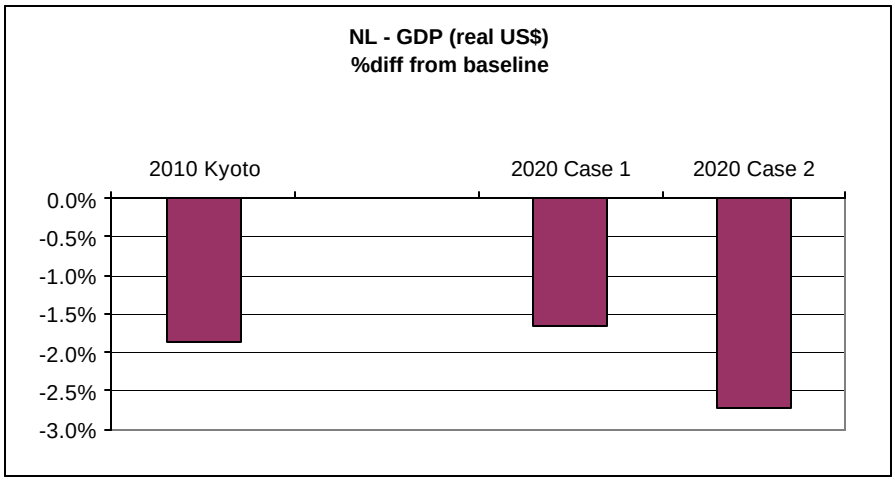
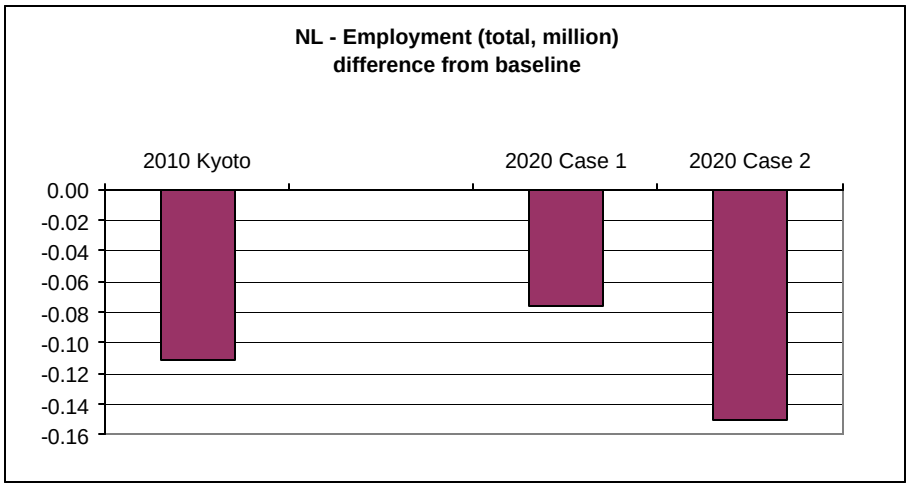


Exhibit 3.



Introduction

In December 1997, the Kyoto Protocol was agreed to by the Conference of the Parties to the Framework Convention on Climate Change. Under this Protocol, the 38 Annex B countries agreed to reduce their greenhouse gas emissions in aggregate to about 5% below 1990 levels for the period 2008–2012. Specific targets were set for each Annex B country with the exception of the European Union countries that agreed to a single group target. Subsequently, the European Union agreed to the quantified targets shown in Exhibit 4.

Exhibit 4
Quantified Emission Limits Established in the Kyoto Protocol
Percentage of 1990 (or Base Year) GHG Emissions Allowed during the Budget Years 2008-2012

OECD Non-European		Transitional Economies		Europe, Western	
OECD North America		Former Soviet Bloc		European Union**	92%
US	93%	Russian Federation	100%	Austria	(87%)
Canada	94%	Ukraine	100%	Belgium	(92.5%)
				Denmark	(79%)
OECD Pacific		Eastern Europe*	107%	Finland	(100%)
Japan	94%	Bulgaria	92%	France	(100%)
Australia	108%	Croatia	95%	Germany	(79%)
New Zealand	100%	Czech Republic	92%	Greece	(125%)
		Estonia	92%	Ireland	(113%)
		Hungary	92%	Italy	(93.5%)
		Latvia	92%	Luxembourg	(72%)
		Lithuania	92%	Netherlands	(94%)
		Poland	94%	Portugal	(127%)
		Romania	92%	Spain	(115%)
		Slovakia	92%	Sweden	(104%)
		Slovenia	92%	UK	(87.5%)
				Other European Countries	
				Iceland	100%
				Monaco	92%
				Liechtenstein	92%
				Norway	101%
				Switzerland	92%

Notes:
Several countries have joined the OECD since 1992.
Not As Annex B Countries: Mexico (1994), South Korea (1996)
As Annex B Countries: Poland (1996), Hungary (1996), Czech Republic (1996)
Several countries were designated Annex 1 (of the 1992 FCCC) countries, but are not Annex B (of the 1997 Kyoto Protocol) countries: Belarus and Turkey.

* The Kyoto target for Eastern Europe was recalculated to reflect Article 3.5 of the Protocol, which allows four countries to use base years other than 1990 -- Bulgaria (1989), Romania (1989), Poland (1988), Hungary (average 1985-1987). The result is to allow them a combined multiple of 107% when applied to the 1990 emission level. The country numbers shown are their official multiple of their base year. [Source: US Department of Energy, Energy Information Administration, *International Energy Outlook 1999.]*

** Agreed European Union internal burden sharing arrangement shown in "( )".

Since 1997, more substance has been put onto the skeleton framework of the Kyoto Protocol. Most of the structures for operation of the Protocol are largely in place, including the so-called flexible mechanisms, operation of sinks, and penalties for non-compliance for the first period (2008-12).

While tightened emission limits for subsequent periods have not yet been specified, they have been under discussion. Recent proposals under consideration are:

Case 1: Current commitment under the Kyoto Protocol through the first period (2008-2012) and a target level of 60% below current (2000) levels of CO_2 emissions by 2050, achieved via a continuous annual reduction per year beyond the first Kyoto commitment period. (For the Netherlands, this results in a target emission rate of 83.5% of 1990 levels in 2020.)

Case 2: Current commitment under the Kyoto Protocol through the first period (2008-2012) and a target level of zero CO_2 emissions by 2050 achieved via a continuous annual reduction beyond the first Kyoto commitment period. (For the Netherlands, this results in a target emission rate of 74.5% of 1990 levels in 2020.)

While advocates push for ratification, most of the Annex B economies are experiencing rising greenhouse gas emissions due to rising population and economic performance.

Study Goals and Design

This study assesses for the cases described above the ***marginal cost of carbon dioxide[3] abatement accounting for projected changes in other greenhouse gases and the resulting economic cost.*** The marginal cost of carbon dioxide abatement is the economic cost of meeting the established targets through domestic measures only. For the purposes of this study, an intra-country tradable permit system is established.

Key assumptions underlying the study are outlined below.

Key Parameters

Targets and Timetable: The goal of this study is to assess the *marginal cost of meeting carbon emissions limits* established for the Netherlands under the Kyoto Protocol and under two proposals for reducing carbon emissions after 2012.

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Further, the so-called Kyoto Flexible Mechanisms such as Joint Implementation (within Annex B) or the Clean Development Mechanism (outside of Annex B) were included in this analysis. These measures would allow countries to reduce carbon emissions in other countries through investments in capital or technology. However, the proposals under consideration by the EU Parliament do not allow credit for these mechanisms.

For this analysis, the US and Japan are assumed not to participate.

Participation: Only the Annex B countries that have announced their intention to meet the targets and timetables of the Kyoto Protocol are assumed to participate. The U.S. has announced that it would not participate, and Japan has announced its intention to rely solely on voluntary measures to meet its commitment.

Intra-country tradable permits only. The results show the minimum economic impact of imposing a carbon emission abatement policy.

Implementation: For this analysis of the marginal cost of meeting carbon emission limits under two scenarios, DRI•WEFA has assumed intra-country tradable permits at the first point of purchase. Analytically, the intra-country tradable permits are similar to a carbon fee. As a fee directly associated with the emission to be controlled represents the marginal cost of abatement, it theoretically is the least cost means of reducing carbon emissions. As a result, the macroeconomic results can be interpreted more broadly: given that carbon fees are the most efficient means of reducing carbon emissions, the results measure the minimum economic impact of imposing a carbon emission abatement policy.

No inter-country trading has been included in this analysis.

No Inter-Country Emission Trading: For this study of the marginal cost of carbon emission abatement within each country. No inter-country trading has been included in the analysis.

No Credits from Flexible Mechanisms: Credits from sinks, JI, or CDM were not incorporated in this analysis.

For this analysis, DRI·WEFA has chosen to return the carbon revenue to consumers through a combination of direct payments and government programs.

Revenue Recycling: Carbon permits/fees, small or large, raise enormous sums of money. To avoid distorting the analysis through effects of the revenue collection, the revenues are recycled to the economy. For this analysis, DRI•WEFA has chosen to return the carbon revenue in its entirety to consumers through a combination of direct payments and government programs. In general, higher energy prices result in higher prices for all goods and services. Recycling of the revenue from the carbon permit fee helps to ameliorate the effects of increased prices. However, the direct payment is not used to ease distributional inequities; it is an equal dollar value per household.

Implications of the Proposed Limits on the Netherlands's Greenhouse Gas Emissions

The ratification and implementation of the Kyoto Protocol would have a significant impact on the energy sectors and economic performance of the Netherlands. The carbon emission reductions for the first period (2008-2012) are significant, and the reductions required to meet either of the proposed emission caps for the second period (2013-2017) and beyond are daunting.

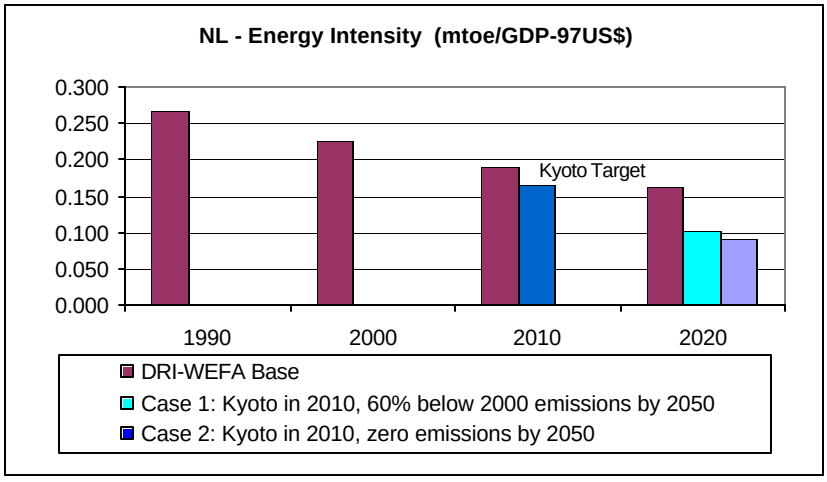
The targets established under the Kyoto Protocol as well as even stringent restrictions will be difficult to achieve as populations and economic output grow.

Exhibit 5: Outlook for the Netherlands

	1990	2000	2010	2020
Population (million persons)	15.0	15.9	16.7	17.1
% change from 2000			5.0%	7.5%
Real GDP (billions of 1997 US$)	292.0	389.2	499.5	633.6
% change from 2000			*28.3%*	*62.8%*
Energy Consumption (million toe)	78.1	87.6	95.5	102.8
% change from 2000			*9.0%*	*17.4%*
Carbon Emissions* (million tonnes)	47.4	50.3	50.0	54.0
% change from 2000			*-0.6%*	*7.4%*
Carbon/Energy	0.61	0.57	0.52	0.53

** from energy use*

Rising population and economic performance will offset the improvement in energy consumption per real GDP – and leading to more thermal energy use and rising carbon emissions.



The economic and demographic outlook drives the outlook for energy use and carbon emissions. Compared to 2000, real GDP is expected to increase 28.3% by 2010 and 62.8% by 2020. The base case projection assumes continued energy efficiency efforts and structural change in the economy, which leads to much smaller increases in energy consumption. However, energy use is still projected to increase 9.0% in 2010 and 17.4% in 2020 compared to 2000. Energy use will

grow with economic performance – albeit at a significantly slower pace. As a result, carbon emissions will also increase.

In this study we have examined the economic and energy sector impacts of the Kyoto Protocol targets and the two proposals for further reductions during the post-2012 period on the Netherlands. The table below shows the target emission levels for all GHG emissions (excluding emissions from international bunkers) relative to 1990 emissions for the year 2020.

Exhibit 6: Target Emissions of Greenhouse Gases (excluding emissions from international bunkers) relative to 1990 emission levels

Netherlands	**2010**	**2020**
Kyoto Protocol	0.945 * 1990	
Case 1: Achieve 60% below 2000 emissions in 2050		0.835 * 1990
Case 2: Achieve zero in 2050		0.745 * 1990

Under the assumption that the Netherlands agrees to meet and maintain the emission level set by the Kyoto Protocol, the Netherlands would have to reduce emissions 14% by 2010 and 20% by 2020. Under the assumption of further emission restraints in the post-2012 period, the Netherlands would have to reduce its emissions by 33-43%.

Exhibit 7: GHG Emissions – Netherlands (million tonnes of carbon)

	1990	2000	2010	2020
Baseline Emissions				
CO2 from Energy Use (src: DRI•WEFA)[1]	47.4	50.3	50.0	54.0
CO2 from Land Use	0	0	0	0
Other Gases (src: Reinstein & Assocs.)	15.9	16.3	16.6	16.6
Total Emissions exc. Intl. Bunkers	***63.3***	***66.6***	***66.6***	***70.6***
Carbon from Intl. Bunkers (src: IEA2001)	10.6	13.7	17.0	18.0
Total Emissions	***73.9***	***82.3***	***83.6***	***88.6***
Target GHG Emissions				
Kyoto Protocol (0.945*1990 emissions)			60	60
Case 1: Post-2012 (60% below 2000 in 2050)				53
Case 2: Post-2012 (zero in 2050)				47
Target for CO2 from Energy Use				
Kyoto Protocol (0.945*1990 emissions)			43	43
Case 1: Post-2012 (60% below 2000 in 2050)				36
Case 2: Post-2012 (zero in 2050)				31
Percent Difference from Baseline				
Kyoto Protocol (0.945*1990 emissions)			-14%	-20%
Case 1: Post-2012 (60% below 2000 in 2050)				-33%
Case 2: Post-2012 (zero in 2050)				-43%
Difference from Baseline				
Kyoto Protocol (0.945*1990 emissions)			-7	-11
Case 1: Post-2012 (60% below 2000 in 2050)				-18
Case 2: Post-2012 (zero in 2050)				-23
[1]*For comparison:*				
CO2 from Energy Use (src: IEA2001)	*42.7*	*45.4*	*50.6*	*56.2*

[2]*Land Use and Forestry changes may be counted once a consensus is reached on this category. This category has not been included in this analysis.*

**2020 set equal to 2010 estimate provided by Reinstein & Assoc.*

Exhibit 8.

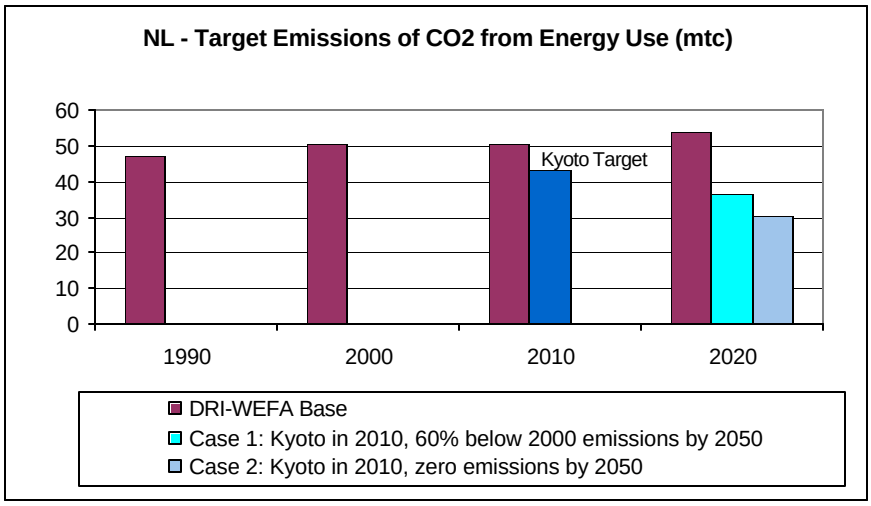


Exhibit 9.

For comparison purposes, the IEA estimate of total GHG emissions is compared to the estimate prepared by DRI·WEFA.

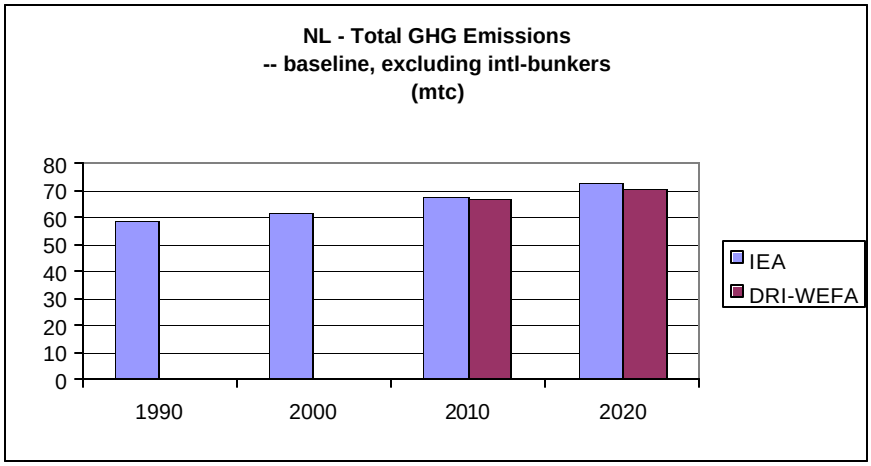
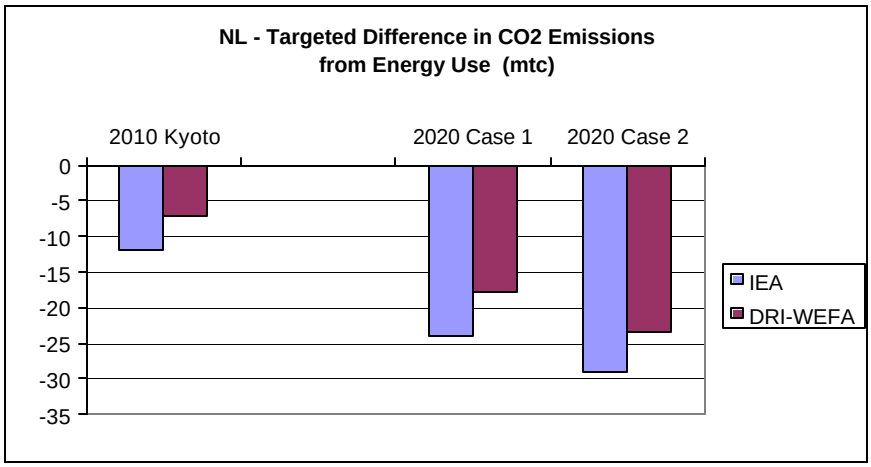


Exhibit 10.



Study Results

Mechanisms for Achieving the Required Carbon Emission Reductions

For the Netherlands to achieve its targeted reductions in carbon emissions would require a dramatic reduction from currently projected levels of energy consumption. As there is no cost-effective technology currently available to capture CO_2 once it is produced, actions to achieve a reduction in carbon emissions from the energy sector over the next few decades fall into three broad categories:

- **substituting non-carbon-emitting fuels for fossil fuel use:** Some emission reductions could be achieved through the increased use of nuclear, hydro, and renewable energy in the generation of electricity. However, it is unlikely given economic and environmental considerations that nuclear or hydro would produce a major portion of the reductions necessary to reach a carbon emission target. ***(For that analysis, no changes were made to the nuclear and hydro assumptions included in the baseline analysis.)*** Under a carbon emission limits policy, other renewable energy technologies would be steadily more economically attractive, but additional R&D is necessary to improve their general applicability. This limits the opportunity for substantial introduction of these technologies during the first Kyoto budget period of 2008-2012.

- **substituting lower emitting fuels for higher emitting fuels:** Switching from fossil fuels with higher carbon emission rates (i.e., coal and petroleum) to those with lower emission rates (i.e., natural gas) can provide some of the reductions needed to reach a target. However, the potential is limited over the next ten to twenty years due to the increasing reliance on lower carbon fuels that is already included in the baseline analysis. Further, the prospect of steady reductions in carbon emissions assumed under for the post-2012 period reduces the incentive for large infrastructure developments needed to expand gas use dramatically.

- **using less energy:** Achieving a carbon emission target through reductions in energy use would require cutting energy use by nearly the same amount as the desired change in carbon emissions from the baseline. To the extent that some of the reductions would be obtained with the two previous options, the necessary reduction in energy use would be less. As these options are not expected to provide substantial relief from the target reductions under the Kyoto Protocol, to achieve this reduction, some form of intervention in the market (such as a fee or tradable permit) would be required. Once in place, energy use would be curtailed through three mechanisms:

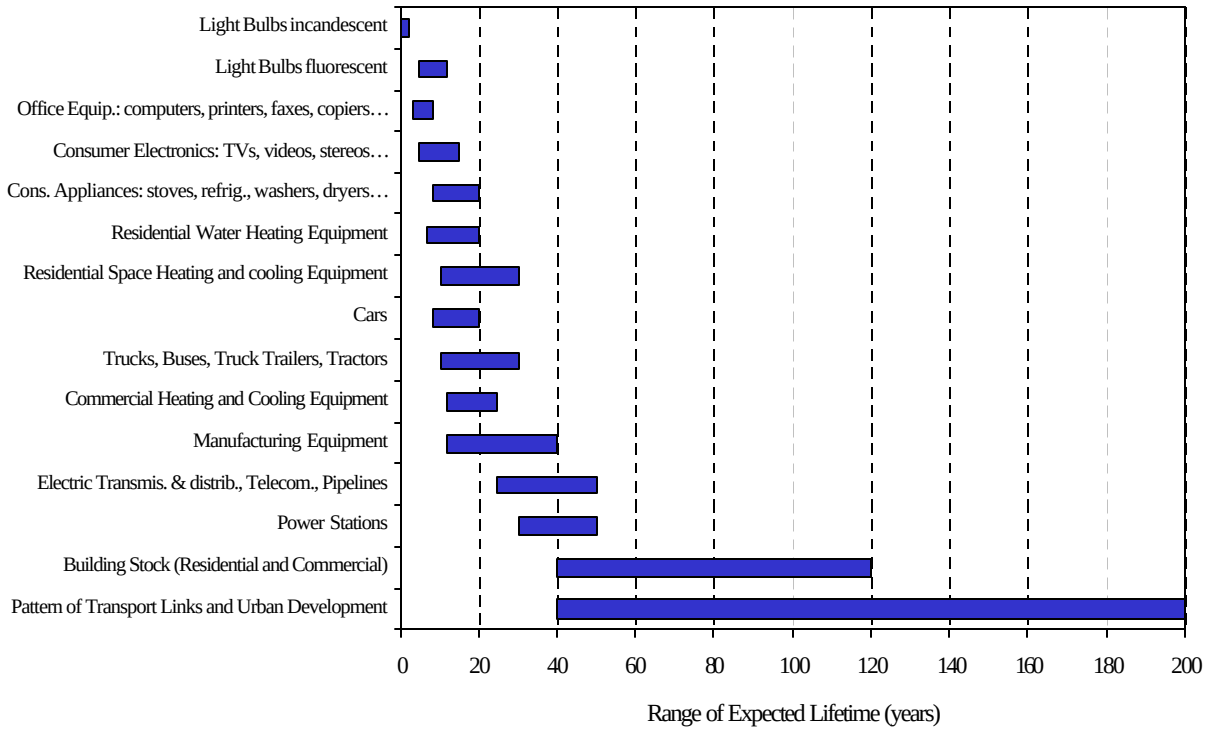
    1. investment in energy efficient capital
    2. investment in process change
    3. reduction in purchases of energy and electricity by businesses and consumers.

The Permit Prices that Achieve the Reduction

As the opportunity for meeting the Kyoto Protocol target emission reductions of CO_2 from energy use through substitution of non-carbon energy sources or low-carbon energy sources is limited, reducing energy consumption would require large changes in energy prices. For the analysis, we have assumed annual permits would be auctioned to primary energy suppliers. With a permit system, the permit would trade at the marginal cost of abatement. In theory, there would be no difference in energy costs under a permit system versus a carbon fee. End-user energy prices would rise by the value of the permit in the first case, and the size of the fee in the second case; the value of the permit and the tax would be the same at the same level of emissions.

Most parties formally involved in the debate agree that the reduction in carbon emissions should be achieved by using market mechanisms -- that is, price signals to consumers and producers. Unfortunately, demand for energy is greatly determined by the cars, buildings, manufacturing equipment, and electrical generating capacity in place at any point in time. Consequently, very large price increases would be required to motivate quantity usage responses until this "hardware" is replaced.

Exhibit 11. Average Life-spans for Selected Energy-Related Capital Stock



Note: *Figures are intended to illustrate typical lifespans, for which there will always be exceptions. For example, some hydroelectric power plants are over 90 years old.*

Sources*: Natural Gas and the Kyoto Pro tocol: Meeting the Expectations, a presentation by Kristi Varangu, IEA, Bonn, June 2000. Chien, 1997; Grubb, 1997; Katz and Herman, 1997; Laitner & Symons, 1997; Appliance Magazine, 1996; Mullins, 1996; U.S. EIA, 1995; IEA, 2000.*

DRI•WEFA's research, in line with the consensus of energy economists, points to only a 3% quantity reduction for each 10% price increase within a decade. Given 25 years, and the turnover of autos, buildings and equipment, the quantity response to a 10% price increase rises to 5-6%. All this means that achieving a very large emission reduction in a relatively short period of time is a very aggressive goal.

DRI•WEFA estimates that for the Netherlands to achieve the required reduction in energy demand and emissions over the first period (2008-2012) a permit price of $114 per tonne of carbon (constant US dollars) would be required. The permit price would rise under both of the proposed targets for the post-2012 period. Under the proposal to reduce GHG emissions to 60% below current (2000) levels by 2050, the permit price would rise to US$196/mtc, and under the proposal to move to zero emissions by 2050 the price would rise to US$245/mtc.

Impact on Delivered Prices to Households and Industry

As shown in the table below, under the assumption of a domestic-only carbon permit trading scheme, the marginal cost of carbon abatement would dramatically increase delivered prices of energy to consumers and business.

Just meeting the Kyoto Protocol target in 2008-2012 would increase the price of home heating oil by more than 23%. Consumers would also pay 9% more for gasoline, and 15% more for diesel.

If the Netherlands participates in the Kyoto Protocol's emission reduction program, prices for industry would rise dramatically. Netherlands's industries would pay more than 71% more for natural gas and more than 97% more for electricity than under the baseline projection.

Under the assumption that the Kyoto Protocol's emission targets are made even more stringent in the post-2012 period, the impact on household heating oil prices would rise to more than 35% above the baseline estimate. Gasoline and diesel prices would rise substantially, between 13-27%.

Impact on Energy Consumption

The percentage reduction in energy demand would not need to be as large as the required percentage reduction in carbon emissions because not all Btus of energy have the same carbon content. However, the reduction in energy consumption is nearly as large as the required reduction in carbon emission. Implementation of an intra-country carbon trading system would result in the following impacts.

Domestic Sector: The dramatically higher energy prices would force consumers to cut their consumption of energy. Since there is only limited opportunity to substitute more energy efficient appliances and furnaces for the period 2008-2012, consumers would reduce their consumption of energy services. Longer term, consumers would attempt to replace some of these services by replacing their energy consuming equipment.

Industry Sector: Industry would respond to the dramatically higher prices through several mechanisms. First, to the extent possible, production of energy intensive goods would move to non-participating countries. Second, industry

would reduce energy consumption through process change. Third, industry would replace energy-consuming capital with more efficient capital.

Power Sector: The power sector would be hard hit under these scenarios. The imposition of carbon permits would lead to extremely high changes in the delivered price of electricity, particularly to the industrial sector. Imposition of ever decreasing carbon permit levels would set in motion dramatic changes in this sector. Coal use would not be sustainable. Investment in natural gas fired generating capacity would alleviate some of the pressure, but with the ever increasing stringency of the target investment in end-use efficiency would need to be as great or greater than power supply efficiency.

Transportation Sector: The impact on the transportation sector would be significant. However, due to the high taxes already in place on transportation fuels, the percentage change in price due to the addition of the carbon permit fees is less than the change in price in other sectors. Longer run, the permit price would have to be high enough to reduce energy use in this sector as the target tightens.

Exhibit 12.
Impact on Netherlands
of Meeting the Kyoto Commitment in 2008-2012 and
Meeting Alternative Targets for the post-2012 period
(Percent Difference from Baseline)

	2010	2020	
	Kyoto: 5.5% below 1990 emissions	Case 1: 60% below 2000 emissions by 2050	Case 2: Zero emissions by 2050
	*.945 * 1990*	*.835 * 1990*	*.745 * 1990*
Targeted Reduction from BAU (%)	*14%*	*33%*	*43%*
Target Reduction of Emissions	*-7*	*-18*	*-33*
Carbon Fee (constant US$/mtc)	*$114*	*$196*	*$245*
Carbon Fee (constant euros/mtc)	*€109*	*€187*	*€234*
Impact on Delivered Prices			
Motor Gasoline, pump price	8.9%	13.3%	15.6%
Diesel, pump price	15.1%	22.5%	26.5%
Home Heating Oil	23.6%	35.0%	41.2%
Electricity, Industry Sector	96.7%	143.1%	164.2%
Natural Gas, Industry Sector	71.3%	100.7%	118.3%
Impact on Economic Performance			
Real GDP	-1.9%	-1.6%	-2.7%
Employment (difference, millions)	-0.11	-0.08	-0.15

Although the percentage reduction in energy demand would not need to be as large as the required percentage reduction in carbon emissions because not all Btus of energy have the same carbon content, the reduction in energy consumption is nearly as large as the required reduction in carbon emission.

Implementation of an intra-country carbon trading system would result in the following:

- Coal, with the highest carbon content of the energy sources, would be the hardest hit.
- Petroleum would experience the smallest percentage decline of the fossil fuels because of its captive transportation market.
- Natural gas demand would initially increase relative to the baseline as it is substituted for coal and petroleum but ultimately would need decline as the cutbacks in demand outweigh this substitution effect.
- The demand for renewables would increase in all the cases.
- For this analysis, it was assumed that nuclear and hydroelectric energy would not change.

Economic Impacts

Output and employment losses would be expected under the Kyoto Protocol because: energy-using equipment and vehicles would be made prematurely obsolete; consumers would be rattled by rapid increases in living costs; and financial ministers would most likely need to target more slack in the economy to deflate non-energy prices and thus stabilize the overall price environment.

The analysis assumes that emission permits would be auctioned to energy producers at the point of first sale. When the government auctions the carbon permits to businesses, the cost of the permit would be passed along to consumers in the form of higher product prices. Consumers' purchasing power would be reduced by the higher cost of using energy, reducing real disposable income.

Consumption and residential fixed investment would be the hardest hit components of real GDP because of the direct loss in real disposable income. The short period to phase in the permit prices (2005-2008) would lead to substantial declines in real consumption from Base Case levels in the 2008-12 period. Imports would strengthen relative to Base Case levels, spurred by the competitive price advantage of the US, other non-participating Annex B countries, and non-Annex B countries.

Real GDP would fall a maximum 1.9% below Base Case levels during the 2008-12 budget period, and 1.6% below in 2020 under Case 1 and 2.7% below under Case 2.

The economy's potential to produce would fall below Base Case levels initially with the cut back in energy usage, since energy is a key factor of production. Stronger investment would be required over the longer-term to build capital as a substitute for this lost factor. The decline in consumption and residential fixed investment relative to Base Case levels, however, would have a depressing impact on business fixed investment in the near-term.

Annual employment losses would be as high as 1.0 million jobs in 2008-10 in the Netherlands. The percentage reduction in employment relative to Base Case

levels would be less than the drop in output. This is due to an increase in the labor-to-output ratio (or a decline in labor productivity) attributed to the permit program. Labor productivity would decline because the other factors of production would be less efficient. Only as investment grows and the capital stock is expanded would productivity begin to improve.

Post 2012, if the target emission level under the Kyoto Protocol is maintained, the impact on economic performance would be reduced. the impact on the economy would begin to lessen. The extreme change in the energy prices experienced during the years between 2005 and 2010 would not be repeated. While the percentage change in prices relative to the baseline would increase somewhat, the year-over-year change in prices would be reduced. However, achieving even more aggressive targets would take ever larger carbon fees, and would continue to take a significant toll on economic performance.

Exhibit 13.

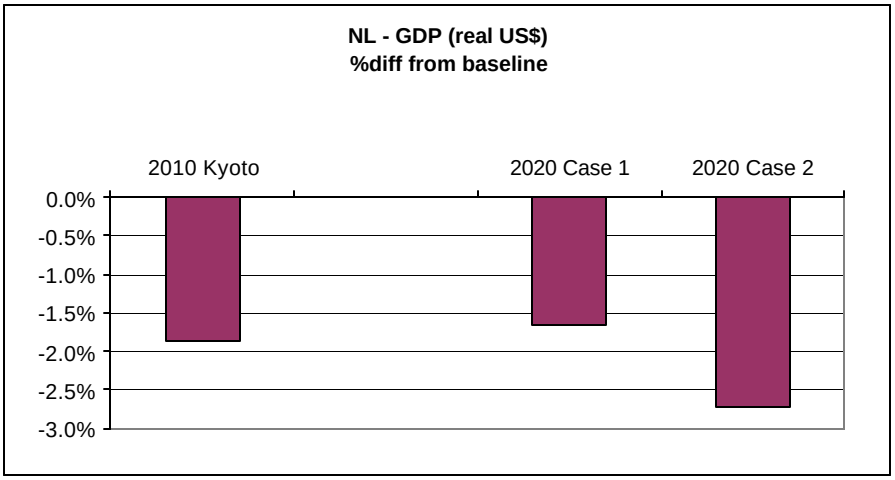
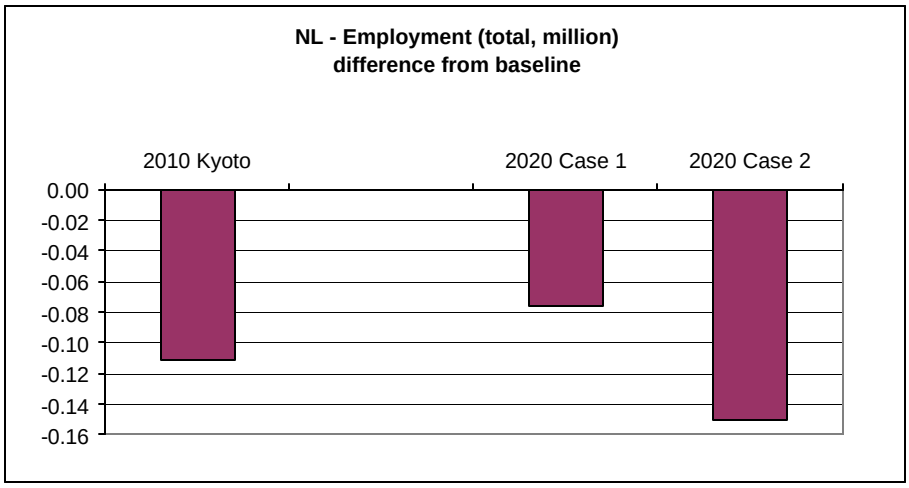


Exhibit 14.



Appendix A: Summary of the Kyoto Protocol

Countries. The Protocol would bind the Annex B countries to quantified emission limits. The Annex B countries, defined in the Protocol, are: US, Canada, Japan, Australia, New Zealand, European Community countries, the countries of Eastern Europe, Russia and the Ukraine. With the exclusion of Turkey and Belarus and the addition of a few smaller European countries, this is the same group of countries referred to as Annex I of the UN Framework on Climate Change (UN/FCCC).

Greenhouse Gases Emissions and Sinks (Carbon Sequestration). The Kyoto Protocol set quantified emission limits on the "aggregate anthropogenic carbon dioxide equivalent emissions" of six greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). To establish the emission target for each country, the first three gases use a 1990 base year and the last three gases may use a 1990 or 1995 base year for the commitment period 2008-2012. The Kyoto Protocol also requires that changes in emissions, relative to 1990 levels, from direct human-induced land use changes and forestry activities which impact this sequestration is counted. These activities have been restricted to afforestation, reforestation, or deforestation. Later, other agricultural soil, land use or forest related sinks might be added.

Quantified Emissions Limits. Netherlands has committed to reduce greenhouse gas emissions to 94.5% of 1990 levels on average over the period 2008-2012. Other industrialized nations have also committed to cap greenhouse gas emissions at various multiples of 1990 emissions for this period. Tightened emission limits for subsequent periods have not yet been specified, but are under discussion.

Emission Banking. As a concept, banking emission credits is allowed from the date that the Protocol becomes effective.

Emission Trading. Emission trading between Annex B countries is allowed, at least conceptually. However, the details, such as the principles, modalities, rules, guidelines, verification, reporting and accountability are still under discussion.

Bubbles. Groups of countries are allowed to treat their aggregate quantified emission limits as a single party (acting under a "bubble"). For example, this provision allows the EU countries to operate under the long-declared EU "bubble" -- individual country emissions can be above or below the 92% of 1990 level target as long as the EU aggregate achieves the targeted level.

Joint Implementation (JI). Joint Implementation (JI) among participating Annex B countries is allowed. These are project-specific emission-reduction efforts undertaken by one Party in another Annex B country. JI projects must be approved by the parties, and generally entail a transfer of a stream of emission credits over time from one Annex B Party to another.

Clean Development Mechanism (CDM). The CDM would allow project-specific reduction efforts in non-Annex B countries. The resulting emission "credits" could then be used by Annex B countries. Certified emissions reductions achieved starting in the year 2000 in developing countries can count toward compliance in the first budget period. A new UN/FCCC body that will certify all CDM and JI projects has been proposed. A share of the proceeds from the CDM projects is to be collected by this body to cover administrative costs and to help developing countries with the costs of adaptation to climate change.

Compliance.. Remains under discussion.

Appendix B: DRI·WEFA Outlook for the Netherlands

	1990	2000	2010	2020
Real Delivered Prices (2000 US$/toe)				
Home Heating Oil	550	609	623	650
Natural Gas, Industry Sector	172	132	129	142
Motor Gasoline, pump price	1507	1399	1599	1664
Diesel, pump price	723	762	826	861
Electricity, Industry Sector (US cents/kWh)	6.48	5.55	6.43	6.01
Energy Consumption (million toe)				
Primary Energy	78.1	87.6	95.5	102.8
Petroleum (1)	35.6	40.0	43.1	45.3
Natural Gas	31.1	35.0	40.7	47.1
Solid Fuels (2)	9.3	8.6	7.9	7.3
Nuclear, Hydro, Renewables (3)	1.7	2.7	2.5	1.8
Solid Waste & Biomass	0.4	1.3	1.3	1.3
Electricity Sales	6.3	8.4	9.8	11.5
Economic Performance				
Real GDP (billions of 1997 US$)	292.0	389.2	499.5	633.6
Nominal GDP (US$)	247.8	408.7	665.4	1152.2
Consumer Price Index (1997=100)	83.9	107.0	136.3	167.3
Wages (billions of 1997 US$)	181.9	180.1	281.9	309.2
Employment (million persons)	5.8	7.2	8.2	8.4

(1) Oil consumption includes international marine bunkers.

(2) Solid fuel consumption and imports include net imports of coke.

(3) Hydro includes geothermal. Renewables include solar, wind and tide, wave and ocean energy.