A comparative analysis of taxes and CO\textsubscript{2} emissions from passenger cars in the Nordic countries

The report discusses how economic instruments can be used to reduce CO\textsubscript{2} emissions from passenger cars in the Nordic countries. The analysis indicate that

- The registration tax and the annual circulation tax can contribute to a reduction in the average CO\textsubscript{2} emission from new cars.
- Company car schemes in the Nordic countries provide incentives for larger cars and increased driving because of subsidies, and this has long term effect as a large share of new cars are registered as company cars but are used as private cars most of their lives.
- CO\textsubscript{2} differentiated taxes can provide incentives to consumers to purchase CO\textsubscript{2} efficient cars.
- Targeted broader packages which besides providing tax incentives also offer advantages to more environmentally friendly cars can be more effective than general tax increases.
- Transparency of targets and instruments is crucial for a large diffusion of CO\textsubscript{2} efficient cars.

The report has been commissioned by the Working Group on Environment and Economics under the Nordic Council of Ministers. The study was carried out by COWI.
A comparative analysis of taxes and CO2 emissions from passenger cars in the Nordic countries

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Preface

In 2008, The Working Group on Environment and Economy under the Nordic Council of Ministers undertook a project “Transport taxes and climate impacts” to map car taxation and key characteristics of the transport sector and car fleet in the Nordic countries. The mapping revealed wide variations across the countries in taxation, car ownership, use and CO₂ emission.

In 2010, COWI was commissioned by The Working Group on Environment and Economy to follow-up on the work by making a comparative analysis of car taxes and CO₂ emissions from cars in the Nordic countries.

This report presents the findings of the analysis. Based on the differences in car taxation in the Nordic countries and the differences and similarities in the composition and use of the car fleet, the report discusses how economic instruments can be used to reduce CO₂ emissions from passenger cars in the Nordic countries.

January 2011,

Øyvind Lone
Chairman, the Working Group on Environment and Economy under the Nordic Council of Ministers
Summary

Introduction

The 2008 mapping of different tax types on passenger cars and lorries in the Nordic countries initiated by the Working Group on Environment and Economics, and updated in this project, forms the basis for this analysis. The data show a great variety in Nordic car taxation, ranging from no registration tax in Sweden, over medium tax in Finland to high tax in Norway and particularly in Denmark. Likewise, there are significant differences in annual circulation tax, and in the tax calculation base. Data also show large differences in the size and composition of car fleets in the Nordic countries, the number of driven kilometres and the associated CO₂ emissions.

The average CO₂ emission per km for new cars is different across the Nordic countries. However, a general and significant reduction has occurred during the last four years in all Nordic countries, as shown in the figure below.

![Average CO₂ emission from new cars, gCO₂/km](chart)

Sources: COWI, based on CDB_AllYears_2010-01-26 Member State Figures and for Norway: Opplysningsrådet for vegtrafikk, 2010, for Finland 2009 and 2010: AKE-fi and for Denmark 2010: Statistikbanken.dk and Alternative fuels in the transport sector, Danish Energy Agency.

The differences between the Nordic countries cannot only be ascribed to the differences in car taxation, but are also the results of a number of different factors in the individual country and their interaction. Such factors include general aspects as economic prosperity, expectations to economic growth and geography, specific aspects, such as taxes on vehicles and fuels, other regulations, tax rules and exceptions such as company car schemes,
transport allowances etc., focus and visibility in CO\textsubscript{2} related policy and regulation in the transportation area, access to alternative transportation in the form of train and bus, and other aspects, such as traditions, consumer attitudes etc.

A comparative statistical analysis only of the car tax and CO\textsubscript{2} emission from cars in the Nordic countries will provide inconclusive results. Instead, the role of the different factors is assessed through the following main hypotheses:

- **Hypothesis 1**: the registration tax and the annual circulation tax can contribute to a reduction in the average CO\textsubscript{2} emission from new cars
- **Hypothesis 2**: company car schemes in the Nordic countries provide incentive for larger cars and increased driving because of subsidies and the focus on these goods
- **Hypothesis 3**: targeted broader packages with a specific CO\textsubscript{2}/car type element are more effective than general tax increases
- **Hypothesis 4**: transparency of targets and instruments is crucial for a large diffusion of CO\textsubscript{2} efficient cars
- **Hypothesis 5**: CO\textsubscript{2} differentiated taxes can provides incentives to consumers to purchase CO\textsubscript{2} efficient cars. Tax restructuring of annual and registration taxes in Norway, Denmark and Finland around 2007 have had significant influence on the CO\textsubscript{2} emission
- **Finally**, it is argued that targeting the new car choices of individuals’ and companies constitute the largest CO\textsubscript{2} reduction potential in the transport sector with the least economic costs

The assessment of the hypotheses is based on model analyses on the COWI Car Choice Model, data analyses and existing studies and reports. The key conclusions and findings are summarised below:

**Registration and circulation tax:**

- The size of the car fleet depends, among other things, on the consumer prices for cars and inherently on the registration tax, if any. The Danish price elasticity of passenger cars is estimated to -0.6\textsuperscript{1} and indicates a significant effect of car taxation on the car fleet. This is likely to be the case across the Nordic countries
- The composition of the car fleet depends of a range of factors besides car taxation. Danish model analysis only foresees minor changes to the average CO\textsubscript{2} efficiency of new cars if the registration tax is abolished. This is because the car fleet will increase and include both more new small and new large cars. Even though the average emission per km does not increase, the growing number of cars results in higher mileage and a rise in the total CO\textsubscript{2} emissions of the transport sector

\textsuperscript{1} Mogens Fosgerau: Road pricing is not always green, DTU, 2010.
A comparative analysis of taxes and CO\textsubscript{2}-emissions

- If the registration and circulation taxes are differentiated according to CO\textsubscript{2} emissions, model calculations show that this will influence the composition of the new car fleet towards more CO\textsubscript{2} efficient cars. In recent years, the Nordic countries have all implemented more or less comprehensive reforms of car-related taxes differentiated according to CO\textsubscript{2} emissions, and the development in the CO\textsubscript{2} efficiency of the new car fleet seems to confirm the trend foreseen by model calculations.

- Despite major structural tax differences, ACEA 2008 figures of the overall tax revenue from passenger cars in the Nordic countries (Denmark, Sweden and Finland) per capita display a relatively uniform overall revenue. This especially covers higher fuel tax proceeds in Sweden and Finland and higher car tax proceeds in Denmark.

**Company car schemes:**

- Nordic company car schemes for passenger cars include a subsidy element of 10–20 per cent, which has a significant impact on the composition and use of the passenger car fleet.
- Cars purchased as company cars are typically larger than private cars and emit on average more CO\textsubscript{2} per kilometre.
- Company cars account for a large share of the car fleet, as 30 to 60 per cent of cars start as company cars in the Nordic countries.
- Company cars drive more kilometres per year than private cars as fuel and other operating costs are free or subsidised, with the result that variable driving costs are low or equal zero.
- Large potential for change as the company car market is a relatively sensitive market, in which amendments to the legislative framework, including society’s attitudes, may influence company decisions and have a rapid impact on car choices, and thereby on the composition of the car fleet.

**Packages of instruments:**

- Tax packages enhance transparency and may provide a seal of approval/quality stamp of certain car types, which could enhance consumer confidence in cars based on a less known technology.
- Factors such as congestion, safety and parking are important to the consumer and could be integrated elements of packages, giving privileges to green cars.
- Apart from the price signal, an integrated part of packages is the effort to bring about the required behavioural change. Especially for the most energy-efficient cars, a number of psychological/knowledge barriers and lack of confidence cannot be overcome by economic instruments alone.
In the Nordic countries and especially in the Danish car market, leasing packages have become very popular. It could turn out to be effective to provide state-subsidised leasing of green cars as part of a package of measures.

Even though the Nordic countries have introduced completely different tax packages, they all follow more or less the same trend towards improving the energy efficiency of new cars sold. So far, Sweden has a higher level of CO$_2$ emissions per kilometre travelled and a lower diesel share. No assessment has been made of the impact of a Swedish registration tax on a par with Danish or Norwegian registration taxes. This would require a detailed county-specific study.

**Increased consumer transparency:**

- The overall costs of different car types are *not fully transparent* to consumers. CO$_2$ emissions may be reduced further by making existing taxation and green transport issues more transparent to consumers, i.e. by informing about costs per kilometre travelled and total costs per year.
- Energy labelling differs across the Nordic countries. In Finland, band A cars must meet more stringent CO$_2$ norms than in Denmark. Norms in Sweden and Norway range in between Finland and Denmark.
- In Norway and Sweden there are *home pages* presenting news about green cars, detailed information to consumers about savings in a one, three and five years perspective by choosing the most energy-efficient car, how car owners may organise themselves and share experiences etc. Such initiatives could be adopted by the other Nordic countries.

Based on these findings, a number of possible Nordic initiatives have been identified which could complement and support national initiatives to reduce CO$_2$ emissions from passenger cars:

- Consolidation and optimisation of existing/proposed CO$_2$ related reforms in the transport sector in the Nordic countries, possibly using good experiences gained in the other Nordic countries.
- Introduction of a common dynamic Nordic green car class, reflecting the gradually improving energy efficiency and CO$_2$ performance. This will establish a bigger and more transparent Nordic market platform for manufacturers of green cars and at the same time increased transparency and profile of the green car market to the customers.
- Nordic cooperation on improved energy labelling of cars, particularly to include the overall annual costs, including fuel costs. Costs may be calculated for 20,000 km travelled annually as used in this study or the variations of 10,000, 20,000 and 30,000 km. Nordic harmonisation of requirements may promote transparency and broader dissemination of information, e.g. on home pages of car manufacturers and car dealers.
• Critical review of all Nordic company car schemes for passenger cars to reduce or abolish tax incentives to buy larger cars and drive more. The Nordic Council of Ministers could raise the issue and initiate a specific study on company car schemes. At European level, the company car subsidy issue seems to be even bigger, and Nordic pressure for a joint European initiative could be considered to promote energy-efficient models as company cars.

Besides the economic instruments analysed in this study, a number of other economic instruments influence the car fleet and its use, including taxation and allowance for work-related transport in private cars in the public and the private sector and income tax deduction rules for commuting.

The instruments discussed above are essential to the design of packages to influence the choice and use of passenger cars. To this end, it is imperative to consider a number of instruments (design of schemes and rates of taxes and levies) together and to design packages of instruments (taxes and rates of levies) which are consistent, produce the optimum effect on CO$_2$ reduction and are efficient in terms of other environmental objectives.
1. Introduction

The purpose of this project is to conduct a comparative analysis of the Nordic countries in order to contribute to an understanding of how the CO$_2$ emissions of the transport sector can be reduced by the use of taxes.

The Nordic countries have different tax structures for passenger cars, which affect the purchase as well as the use of these. In the analysis of the countries, a good starting point is the analysis of the car fleet and the traffic volume – and thus the CO$_2$ emissions from passenger transport.

The analysis is based on the TemaNord 2008:578 mapping tax types on passenger cars and vans in the Nordic countries.

COWI A/S has updated and supplemented these data with help from internal and external consultants in the Nordic countries in order to clarify the effect of tax structures on the car fleet and CO$_2$ emissions. In addition, national statistics are used.
2. Problem, method and data

Differences in size and composition of car fleets in the Nordic countries, the number of driven kilometres and the associated CO$_2$ emissions are a result of a large number of factors and their interaction. These include for example:

- general factors such as the economic prosperity, expectations to economic growth and geographical features of the countries
- specific factors such as car taxes and fuels
- other relevant regulations, taxation and exemptions such as company car schemes, transport allowances and more
- focus and transparency in CO$_2$ related policy and regulation in the transportation area, including consistency between regulations and instrument packages
- accessibility to alternative transportation in the form of train and bus, traditions, consumer attitudes and more

The car fleet and its composition as well as the traffic volume and its development are determined in a complex interplay of these factors, including also expectations to the development in the factors. In addition, a number of other factors, such as national culture/traditions and road infrastructure play a role. Therefore, the explanation of for example car ownership cannot be ascribed one single factor such as registration tax or annual tax for cars.

Simultaneously one can imagine that the demand for cars and car transport will saturate when the level of car ownership and annual traffic reach a certain level, especially if there is no continuous extension of the capacity of the road infrastructure.

The many factors and the complexity of the interaction between the factors affect how a comparative analysis of taxes and CO$_2$ emissions from passenger cars in the Nordic countries is approached.

A simple statistical analysis would be insufficient in the testing of different hypotheses, for example the relationship between specific taxes, car ownership, car fleet composition and traffic volume. The complex interaction between several factors implies that the assessment should be carried out in the form of discussions based on examples and analysis of data with related conclusions.
2.1 Data and data comparison

To the extent that data and time series for all the Nordic countries are available, these are applied; otherwise country examples are used to substantiate points.

Data have been extracted from existing studies (including TemaNord 2008:587) and the national statistical agencies, and a questionnaire has been launched in each of the Nordic countries to gather additional information and update selected data. The questionnaire gathers data particularly concerning significant changes in taxes and recent analysis of effects of taxes and tax changes.

Furthermore, model calculations in COWI’s Car Choice model modified by 2008 data are used. The model is used to calculate examples that can illustrate and support the assessment of some hypothesis.

The results of the Car Choice model comprise information about aggregated tax revenues, energy consumption, car prices and composition, \( \text{CO}_2 \) emissions etc. of new cars. Thus, the Car Choice model estimates the composition of the car fleet by changed input data, e.g. the implementation of a registration tax differentiated according to \( \text{CO}_2 \) emissions.

Throughout the report, there will be references to data, both directly as figures in the text and as references to data in appendix. Data in appendix include:

- The car fleet in the five Nordic countries distributed on fuels
- The age of the car fleet, both the average age and the share of the fleet that is more than 10 years old
- Taxes in the Nordic countries, both registration taxes, annual taxes and fuel taxes
- Emission data for the car fleets of the Nordic countries
- Total taxes for seven selected cars in the Nordic countries

2.1.1 New car types

In the report, we have focused on new and more climate friendly car types, which offer relatively high \( \text{CO}_2 \)-reductions from passenger cars. They are being introduced now and in the coming years and are therefore particularly relevant to study. By use of Nordic case examples, we study how taxes in conjunction with other instruments can be used to accelerate and maintain the desired development of ever more energy efficient cars.

2.1.2 Passenger car costs in the Nordic countries

We have calculated the different consumer costs of passenger cars in the Nordic countries. Taxes and user costs vary among the Nordic countries, partly due to the application of different tax types and partly due to different
A comparative analysis of taxes and CO\textsubscript{2}-emissions

rates for the applied tax type. For example, all countries have annual owner taxes, but rates and calculation basis vary. Most countries have a registration tax, but with large differences. Such differences is expected to affect the pre-tax prices of the cars, so that rebates from car manufactures to some extent may compensate for the higher taxes in some countries. Annual circulation taxes also vary and so do tax exemptions and fuel taxes.

To assess the effect on consumer costs, specific car models are selected, and the total user costs calculated assuming an annual mileage of 20,000 km.\textsuperscript{2} The following car types have been selected:

- Citroën C1 1.0i: small energy efficient car
- Toyota IQ 1.4D: small diesel car
- Hyundai i10: inexpensive petrol car
- Toyota Avensis: middle class car
- Toyota Prius: energy efficient middle class car (hybrid)
- Volvo S40 DRIVe: middle class diesel car
- Ford Focus 1.6 TDCI DPF: middle class diesel car
- Hyundai ix35: large diesel car
- Lexus RX 450h MPV: expensive, large hybrid
- Think: small, electric car

The analysis provides a comprehensive picture of the consumer costs in the Nordic countries that allows for a comparison of the private economic conditions.

Focus is on total cost differences rather than on the specific taxes, i.e. focus is on consumer prices and thus takes into account any partial compensation through pre-tax prices. There are large differences in registration taxes and annual taxes between the Nordic countries (the registration tax is 0% in Sweden, 40% in Finland, up to 120% in Norway and up to 180% in Denmark). There are only small differences in the taxes on petrol and diesel between the Nordic countries (Iceland exempted).

The following table shows a calculation of costs per km for selected cars across the Nordic countries, including purchase costs, taxes, operating costs and fuel consumption. Prices are exclusive of insurance costs.

\textsuperscript{2} The annual traffic volume does not reflect the actual conditions in the Nordic countries and as such it does not include national differences in traffic volumes.
Table 2.1 Costs of selected cars, EUR/km

<table>
<thead>
<tr>
<th>Make</th>
<th>EURO per km</th>
<th>Price euro/km</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>km/l</td>
<td>Fuel l/year</td>
</tr>
<tr>
<td>Citroën C1</td>
<td>22.2</td>
<td>910</td>
</tr>
<tr>
<td>Toyota iQ</td>
<td>25.0</td>
<td>800</td>
</tr>
<tr>
<td>Hyundai i10</td>
<td>20.0</td>
<td>1000</td>
</tr>
<tr>
<td>Toyota Avensis</td>
<td>15.2</td>
<td>1316</td>
</tr>
<tr>
<td>Toyota Prius</td>
<td>25.6</td>
<td>781</td>
</tr>
<tr>
<td>Volvo S40</td>
<td>25.6</td>
<td>781</td>
</tr>
<tr>
<td>Ford Focus</td>
<td>22.7</td>
<td>881</td>
</tr>
<tr>
<td>Hyundai ix35</td>
<td>16.4</td>
<td>1220</td>
</tr>
<tr>
<td>Lexus RX MPV</td>
<td>15.9</td>
<td>1258</td>
</tr>
<tr>
<td>Think</td>
<td>7.1</td>
<td>2813</td>
</tr>
</tbody>
</table>

Source: COWI, list prices.

The table shows that the costs of per km differ across the Nordic countries. However, the differences are limited, particularly for the cheapest cars. This indicates that, relatively, the registration tax does not play as significant a role for these cars as could be expected. Norway has the highest costs in this particular segment.

The largest difference in costs per kilometre is found in the case of the Lexus hybrid, which is twice as expensive in Denmark as in Sweden. Danish costs of the Lexus MPV and the Toyota Prius are significantly higher than the corresponding costs in Norway, Iceland and Finland. This is because there are no tax benefits for hybrid cars in Denmark besides the potentially lower fuel costs. Danish registration tax is primarily based on car prices, and as Prius and Lexus are expensive cars, the tax structure broadens the gap between the countries. This makes purchase of these cars less advantageous in Denmark compared to the other Nordic countries. The tax structure in these countries provides incentives to buy eco-friendly cars. This is seen when comparing to the costs per kilometre of the Hyundai ix35, which has almost the same net weight as the Lexus RX MPV. These are the same in Norway and Denmark, whereas it is approximately 25% more costly to drive the Lexus in Denmark compared with Norway due to the tax structure.

The only electric car included is Think for which data are only available from Norway. The costs of the Think are in the low end, which would also be the case in the other Nordic countries, partly because fuel costs are low. In Denmark, electric cars are exempted from registration taxes until the end of 2015, and in several of the other Nordic countries electric cars are, as other green cars, exempted from annual taxes for a number of years. All Nordic countries have implemented measures that aim to accommodate a critical mass of electric cars. Critical mass is a central factor concerning the necessary infrastructure, such as charging stations.
3. Framework for car transport in the Nordic countries

There are significant welfare gains associated with transport in the sense that people are willing to let transportation be very costly and time consuming. Applying this as a welfare gain indicator implies that transportation has significant economic consequences and that it is difficult and potentially costly to “force” car ownership and traffic volume down by increasing or introducing new taxes.

Using taxes as a means to affect car ownership, composition and use take place through private economic incentives. Taxes and tax increases enhance the private economic costs of purchase and/or use of the car compared to the situation without taxes or with lower taxes.

However, it is assumed that it is not the tax, but the final consumer price that is crucial. If the tax is offset by lower pre-tax prices, the consumer price will not be changed. This is obviously not generally the case, but such an effect can be observed on the car market. There are relatively low pre-tax prices in Denmark compared to Sweden, a fact which is often explained by high registration taxes in Denmark and a desire from car dealers to maintain the market despite these taxes.

Despite differences in car taxation, the Nordic countries are roughly on the same level when it comes to car ownership and traffic volume. This is partly due to the fact that vans are taxed lower in both Denmark and Norway and that some vans for this reason are used for passenger transport. Taking this into account the Danish level for car ownership is around 15% below the Swedish which is the highest in the Nordic countries.

With increasing wealth, even relatively high taxes appear to be a limited barrier to a household’s car purchase, implying a high willingness-to-pay for a car. In Denmark, car ownership has increased by 32% and car transport by 73% in the period 1980–2005.

3.1 Car ownership

In Nordic countries with high registration taxes, the effects of the high taxes on the passenger car ownership is partially off-set by reduced taxation of vans, of which some are used for private passenger transport.
3.2 Car choice

The high registration taxes in Denmark and Norway affect the price of the car that the consumers choose. There is some but not an unambiguous connection between the price of the car and the CO₂ emission of the car. Often expensive cars have larger CO₂ emission than cheaper cars and have higher fuel consumption per kilometre. However, especially in recent years, more fuel-efficient but relatively expensive cars have appeared.

As an example can be mentioned cars that rely on hybrid technology. In Denmark it is described as the “Prius effect”, when an environmentally friendly car such as the hybrid car Toyota Prius is more expensive than a similar, less energy-efficient car (for example the popular Toyota Avensis). This is because the sales price is scaled up by the largely value based tax system. Very few Toyota Prius are sold in Denmark, whereas the other Nordic countries experience a sales of a couple of thousands each year (see appendix 1).

In recent years, Denmark, Finland and Norway have introduced registration taxes differentiated according to CO₂ emissions per kilometre. It is our hypothesis that the differentiation has had an impact (see hypothesis 5). However, these changes are recent and assessment of the impact is difficult due to the economic crisis, which also plays a role in the choice of car model. It is not possible for us to distinguish the impact of the economic crisis from the impact of changes in the registration tax.

In each of the Nordic countries, there are differences in the CO₂ emissions from cars in rural areas and in urban areas. In the cities public transport system offer an alternative to car transport. Some cities have also introduced a congestion charging to help solve traffic and air pollution issues. For instance, there has been registered reduction in CO₂ emissions
from passenger cars in Stockholm and Oslo, as a result of the introduction of road tolls.

The Nordic car owners also have heritage common preference for cars that can serve more purposes, e.g. city-dwellers, who could actually settle with a “Smart”, also want a larger car suited to go to their summer houses or country place in weekends and holidays. This places demands on the car’s size and traction.

3.3 Car fleet tendencies

The average CO$_2$ emissions per kilometre from new cars are different in the Nordic countries, but common to all countries is that the average emission has decreased, particularly over the last four years.

![Figure 3.2. Average CO$_2$ emissions from newly registered cars.](image)

In this period of time, there has been a technological development towards less CO$_2$ emission from new passenger cars. Most car producers now promote relatively inexpensive and comfortable diesel engines for their passenger cars, which mean that diesel cars now represent a large part of new cars in all the Nordic countries.

3.4 Environmental alternatives

Furthermore, several car producers offer variants of their traditional models, which have relatively low CO$_2$ emissions per kilometre. These models are interesting e.g. for companies that wish to strengthen their environmental profile. The following table illustrates this trend.
A comparative analysis of taxes and CO2-emissions

Table 3.1 Examples of energy efficient model-variants

<table>
<thead>
<tr>
<th>Make</th>
<th>CO2 emission of available diesel (g/km)</th>
<th>Reduction CO2 (%)</th>
<th>Energy programme</th>
<th>Comment from</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VW</td>
<td>13</td>
<td>9</td>
<td>BlueMotive</td>
<td>Power remains scheduled for</td>
</tr>
<tr>
<td>VW</td>
<td>15</td>
<td>11</td>
<td>BlueMotive</td>
<td>Power remains scheduled for</td>
</tr>
<tr>
<td>Volvo</td>
<td>12</td>
<td>10</td>
<td>DRIV</td>
<td>Power remains</td>
</tr>
<tr>
<td>Ford</td>
<td>11</td>
<td>9</td>
<td>Econetiq</td>
<td>Power ?</td>
</tr>
<tr>
<td>Mercedes</td>
<td>16</td>
<td>12</td>
<td>BlueEfficiency</td>
<td>Power ?</td>
</tr>
<tr>
<td>Mercedes</td>
<td>16</td>
<td>13</td>
<td>BlueEfficiency</td>
<td>Power remains 125</td>
</tr>
<tr>
<td>BMW</td>
<td>15</td>
<td>11</td>
<td>Efficient</td>
<td>Power ?</td>
</tr>
<tr>
<td>BMW</td>
<td>15</td>
<td>12</td>
<td>Efficient</td>
<td>Power ?</td>
</tr>
</tbody>
</table>

Source: Transport and Environment, Brussels, (T&E) 2009.3.5 Traffic volume

It is not the car ownership in itself that determines the CO2 emission, but the traffic volume and the car type. The following figure shows the approximate average traffic volume in the Nordic countries (data for Iceland are missing).

Figure 3.3 Average traffic volume. km/passenger car, 2006.

The figure indicates that Danish citizens drive 15% more km in their car than the Norwegian and Swedish citizens, and thus offsets the lower car ownership through higher traffic volume per vehicle. It is noted that the difference in country size and urbanisation may influence traffic volumes and car ownership, but this relation is not unambiguous. The urbanisation rate in Finland is
A comparative analysis of taxes and CO$_2$-emissions

63.9%, in Sweden it is 84.7%, in Denmark 87%, in Norway 77% and in Iceland 92%.

Projections of traffic volumes in both TemaNord 2008:587 and in the 2010 report from Nordic Energy “Foresight Analysis – Nordic Strategies for Renewable Transport” show an expected continued increase in the traffic volume for passenger cars in all the Nordic countries up to 2030 and 2050, unless further policy action is taken.

3.6 Decline in transport volume

By contrast and for the first time in many years, the economic crisis in recent years has shown that it is actually possible too see a decrease in the transport volume. In August 2010, the Danish Road Directorate informed that car traffic is declining and that during the first three months of 2010 car traffic fell by 4.4% compared to 2009. At the same time, the Danish Railways (DSB) experienced an increase of passengers of 2.5%.

3.7 Decline in CO$_2$ emissions

Reduced emission of CO$_2$ due to increased energy efficiency and improved CO$_2$ performance of the cars risk to be offset by growth in traffic volume. It does not seem clear if Nordic passenger transport will keep growing after the economic crises. If so additional tax instrument in the future to reduce/stop the increase in car kilometres may be effective, particularly if attractive alternatives are offered.

New car models and economic awareness among companies and consumers have created a “window” where the interest in, and thereby the opportunity to affect car owners behaviour by taxes are larger than ever. In the following chapters, we discuss some hypotheses on possible tax instruments that may have the potential to promote CO$_2$ reductions from passenger cars in the Nordic countries.

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1 According to CIA, USA 2008 figures “The World Factbook”, theme “Urbanisation
3 Statistics from Danish Railways (DSB).
4. Setting up hypothesis

In the Nordic countries today, there is a wide range of opportunities to use the tax/subsidy instrument for the reduction of CO$_2$ emissions in the transport sector. Sweden, Finland and Denmark have through their EU-membership binding CO$_2$ targets for the sectors not covered by the EU CO$_2$ emission trading system, such as the transport sector, but all countries have binding Kyoto targets.

When using tax instruments to reduce CO$_2$ emissions in the transport sectors of the Nordic countries, it is important to recognize the potential of conflicting interests including:

- Car manufacturers and importers may earn more on expensive cars, with higher CO$_2$ emissions, and prefer to sell these
- More energy-efficient cars will reduce fuel sales and reduce government revenues from diesel and gasoline taxation and possibly raise the need for alternative financial sources for governments. In a country as Denmark, the government retrieves around DKK 50 billion per year from transport sector taxes, in Sweden SEK 87.5 billion and in Finland around DKK 50 billion.\(^6\) Note that overall income is fairly similar across countries

In this project, the revenue issue is not analysed and assessed, Figure 4.1 below shows the main causality between CO$_2$ emission and transport.

The emissions of CO₂ from the transport sector basically depend on:

- Transport volume, represented by demand for transport of people and goods. The demand is determined by numerous factors, including the costs of transportation and is thus affected by variable taxes such as fuel taxes and road charges which increase the variable costs of transportation
- The energy efficiency of transport. The energy efficiency is determined by a number of factors, such as choice of transport means, the number of passengers in the car and the car’s energy efficiency. These conditions may also be affected by taxes and other economic instruments
- The composition of fuels used for transportation. The emission of GHG from energy consumption depends on the fuel used. The emission of GHG from biofuels is for example often less than from fossil petrol and diesel, depending on the specific biofuels and production method. Choice of fuel can also be affected through taxes and taxes

Each of these elements can be affected by the use of taxes and other economic instruments, and thus the CO₂ emissions from car transport. How, and to what extent the economic instruments affect the CO₂ emission from car transport however both depends on the composition of taxes and on the general framework conditions of the transport sector. Examples of framework conditions are the availability of infrastructure and public transport services, geography and population density etc.
The table below illustrates the major tax instruments relevant to the car fleet and the transport sector and indicates the primary impacts on the car fleet size, the composition with respect to energy efficiency and CO₂ emission as well as the overall transport consumption. Where relevant it also indicates how the tax works, for example, whether the key parameter is the size of the tax, or whether the impact goes through differentiation of the tax, in other cases just that the tax has an impact (market with x). However, taxes often have a significant impact on all three. Finally, it is indicated whether there is a significant difference between the tax/instrument within or between two or more of the Nordic countries.

Table 4.1 Major tax instruments in the transport sector.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Size of car fleet</th>
<th>Composition of car fleet</th>
<th>Overall transport consumption</th>
<th>Important differences Transport consumption between the Nordic countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration tax</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Annual car tax</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Fuel tax</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Exemptions/subsidies</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Driving tax</td>
<td></td>
<td>Level, dissemination</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Congestion tax</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Road tool</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Transport allowance</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Company car tax</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>(X)</td>
</tr>
<tr>
<td>Other instruments, (e.g. promoting car sharing, electric, cars, etc.)</td>
<td></td>
<td></td>
<td></td>
<td>(X)</td>
</tr>
</tbody>
</table>

Source: COWI.

Note: x denotes that the tax is common and (x) that the tax is less common.

4.1 Analytical limitations

In certain areas it is possible to identify differences between the Nordic countries, for example substantial differences in tax structures and thus to some extent to assess the effects of the tax.

There are other areas, where a comparative analysis does not allow us to identify impacts, because data are of poor quality, because legislation is almost identical for the countries, or because the interlinkages with other impacts are so complex that reliable results require a larger, more in dept, study than possible here. We will briefly touch on these below.

Passenger cars and vans are treated together whenever possible as these to some extent are substitutes. In Denmark, for example an important share of the vans in practice serves as passenger cars, but we do not know exactly how many.
4.1.1 Increased fuel taxes

All the Nordic countries have significant fuel taxes. The fuel taxes are roughly on the same level and also coordinated with Germany in the south. Taxes are higher in Germany but profits lower, resulting in comparable consumer prices. There is thus no basis for a comparative analysis of the effects of the fuel taxes, but generally it is considered well documented that increased fuel taxes (and expectations about this) have an effect on the traffic volume and the choice of car.

4.1.2 Importance of the car’s age

The car fleets in the Nordic countries have comparable ages (the average age is 9.1 years in Sweden and Denmark, 10.2 years in Norway, 10.5 years in Finland and 10.2 years in Iceland).\(^7\),\(^8\) The average age for passenger cars in Europe according to ACEAS data is 8.5 years.\(^9\)

The significance of age to the CO\(_2\) emission is difficult to assess. The main issue is how much the more polluting cars are actually driven. We have not found comprehensive Nordic data for the mileage for car distributed on type or age. The relationship between the registration tax and the age of the car fleet is not clear. There is a tendency for the car price to approach the same low level when the cars get older across countries, and there is a market for these cheap cars in all countries.

For example, Finland has a relatively low registration tax, but the oldest car fleet. The reason might be that lower registration tax gave an incentive to buy larger cars with longer lifetime. On the other hand, Sweden, with no registration tax, has a relatively young car fleet, suggesting that the lower purchase price gave an incentive to scrap the cars earlier.

However, also subsidies for scrapping of old cars exist. Sweden has the highest scrapping subsidy\(^10\) (SEK 10,000 in the period up to 2007, SEK 8,500 in 2008 and SEK 6,500 in 2009). This could indicate that the high scrapping premium does have an effect. The TemaNord 2008:587 table 64 shows a significant reduction in the average age of the car fleet in Sweden, from was 9.6 years in 2000/1 to 9.1 in 2007. This supports the view that the scrapping bonus has had an effect. However, at the same time a rather large share of cars are over 10 years of age in Sweden (43% in Sweden, 37% in Denmark and 50% in Norway), indicating limited effects of the subsidy. Scrapping of older, but operational cars could however be a concern in rela-

\(^7\) Source: Figures from “Iceland Road Administration”, 2010, from http://www.icenews.is/index.php/2010/03/21/nordic-region-cars-among-europe%e2%80%99s-oldest/#more-13064
\(^8\) TemaNord2008:587.
\(^9\) http://www.icenews.is/index.php/2010/03/21/nordic-region-cars-among-europe%e2%80%99s-oldest/#more-13064
\(^10\) SEK 8500 car scrapping premium in Sweden compared to DKK 1750 in Denmark.
tion to CO₂ emissions, as CO₂ is also a significant by-product of the car production.\textsuperscript{11}

4.1.3 Income tax deduction for commuting

The income tax deduction for commuting can be dependent on the choice of transport mode and the CO₂ emission and have an impact on the choice of car. In Denmark today, fringe areas have higher transport allowances than other areas. In Finland, transport allowance is only given, if there is no suitable public transport.

The effect of the Danish “Lupo Act” in 2003 illustrates the potential for this kind of instruments. The Lupo, which at the time was by far the most energy-efficient car on the Danish market, was by reduction in the registration tax in 2003 made relatively inexpensive in Denmark. As a consequence, many purchased the car in this period. Denmark was the country that bought relatively most of the cars, and many of these are/was being used for commuting.\textsuperscript{12}

4.1.4 Use of own car for business purposes

All the Nordic countries have compensation schemes for the use of own car for business purposes. The relationship is, however, primarily between the employer and the employee and mainly a question about which car or transport mode rather than whether there is a need to make the individual trips. In both Denmark, Norway and Finland the compensation can reach over DKK 3 per kilometre, and this can provide an incentive to use the private car for business rather than using public transport. The compensation is in all countries independent on the type of car driven. For more details, see Appendix 1.

4.2 Five hypotheses

The following main hypotheses will be tested and discussed in the next chapter based on collected Nordic data.

- Hypothesis 1: the registration tax and the annual circulation tax can contribute to a reduction in CO₂ emission from cars
- Hypothesis 2: company car schemes provide incentive for larger cars and more driving because of subsidies and the focus on these goods.


\textsuperscript{12} Tetraplan, “Bilafgifter og energiforbrug 2008 [Car costs and energy consumption]”. 
The hypothesis is that all the Nordic countries indirectly subsidise company cars which increase the CO\textsubscript{2} emission

- Hypothesis 3: targeted packages of instruments can provide great impact. It is essential for the effect that tax costs and options are clear to the consumers. Broader packages with a specific CO\textsubscript{2}/car type element are more effective than general tax increases

- Hypothesis 4: transparency of targets and instruments is crucial for a large diffusion of CO\textsubscript{2} efficient cars. The tax instrument has been very important in the introduction of new car types such as electric and hybrid cars in the Nordic countries. Visible political support seems to be an important supplement

- Hypothesis 5: CO\textsubscript{2} differentiated taxes can contribute to purchases of CO\textsubscript{2} efficient cars. Tax restructuring of annual and registration taxes in Norway, Denmark and Finland around 2007 have had significant influence on the CO\textsubscript{2} emission

Finally, it is argued that targeting impacts on individuals’ and companies’ choice of new cars have the largest CO\textsubscript{2} reduction potential in the transport sector with the least economic costs.
5. Discussion of the hypotheses

The following discussion of the hypotheses is based on comparative analyses of Nordic data with emphasis on data for recent years, supplemented by case examples.

5.1 Hypothesis 1, registration tax and annual circulation tax

*The registration tax and the annual circulation tax can contribute to a reduction in CO\textsubscript{2} emissions from cars.*

The focus here is exclusively on the size of the tax as an instrument to reduce CO\textsubscript{2} emission from passenger cars. Tax differentiation according to CO\textsubscript{2} emission per kilometre is treated separately in Hypothesis 5. A combination of size and differentiation of the registration tax is not discussed here, as the desire is, to the extent possible, to detect the effects of the individual taxes and tax measures. Focus is on the registration tax and less on the annual tax.

The effect of the registration tax on the cars’ CO\textsubscript{2} emission is determined partly by the tax effect on car ownership, and partly on the composition of the car fleet.

5.1.1 Car ownership

Tax differences result in marked differences in consumer prices for cars across the Nordic countries. As shown in Figure 3.1, there are only limited differences in the total car ownership in the Nordic countries, but as the figure shows, this is to a certain extent because some citizens choose to use lower taxed vans in Denmark and Norway, and that the registration tax does not acquire its full impact.

Differences in car ownership in the Nordic countries cannot only be ascribed differences in the registration tax. The following table shows average prices for cars as well as car ownership in the Nordic countries.
A comparative analysis of taxes and CO2-emissions

Table 5.1 Average car prices and car ownership in the Nordic countries

<table>
<thead>
<tr>
<th>Index for car prices (2007) (EU=100)</th>
<th>Sweden</th>
<th>Finland</th>
<th>Norway</th>
<th>Denmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger cars/1000 inhabitants (2006)</td>
<td>485</td>
<td>492</td>
<td>445</td>
<td>370</td>
</tr>
<tr>
<td>Vans/1000 inhabitants</td>
<td>46</td>
<td>19</td>
<td>71</td>
<td>84</td>
</tr>
</tbody>
</table>

Sources: The Polk ROADTODATA Euro Index for Quarter Three 2007 and TemaNord 2008:587

The price gives only a limited explanation to car ownership. Even with significantly higher car prices in Finland than in Sweden, the car ownership for passenger cars is higher in Finland than in Sweden. Likewise, the average price is significantly higher in Norway than in Sweden, but the passenger car ownership is only 8% lower. This emphasizes that there are other differences among the countries affecting car ownership than just the price.

To assess the significance of taxes on the car ownership, modelling calculations are used, based on for the significance on car ownership in Denmark, i.e. calibrated according to Danish data and registration taxes. The average tax incl. VAT (25%) on newly registered cars in Denmark is 160%.

The model is used for assessment of the effects of reducing the Danish registration tax and in return introducing a road charges.

Table 5.2 Number of cars per household

<table>
<thead>
<tr>
<th>Current situation</th>
<th>Half registration tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share with 0 cars</td>
<td>0.43</td>
</tr>
<tr>
<td>Share with 1 car</td>
<td>0.46</td>
</tr>
<tr>
<td>Share with 2 cars</td>
<td>0.11</td>
</tr>
<tr>
<td>Cars per household</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Source: Mogens Fosgerau: Road pricing is not always green, DTU, 2010.

Cutting the registration tax in Denmark by half is thus estimated to increase the car ownership by 20%, reaching the Swedish level.

Halving the registration tax will on average also bring Danish consumer prices on passenger cars closer to the Swedish prices. The average price (compared to a European average of index 100) is 98 in Sweden against 193 in Denmark. With unchanged car composition, halving the registration tax would bring the Danish price index on cars down to 135 compared to the EU average.

This indicates a car ownership at the Swedish level, even though the Danish tax level on new cars is significantly above the Swedish. The average price however covers significant variations. Halving the registration tax would bring prices on smaller cars in line with Swedish prices for similar cars, whereas large cars would still be significantly more expensive. because of the progression in the Danish car tax.

13 Mogens Fosgerau: Road pricing is not always green, DTU, 2010.
15 Assumed average tax 160% incl. VAT, reduced to 80% incl. VAT: (193/260)*180=133.
In conclusion: The registration tax has an impact on car ownership. The concrete price elasticity in car ownership depends on the country-specific conditions and varies between the countries. Based on the results from the model calculations and under Danish conditions, the price elasticity is estimated to be around -0.6. Even though we have no estimation of the price elasticities in the other Nordic countries, it seems fair to assume elasticities at the same level.

It is possible to use the Danish model for the other Nordic countries as well, but this will require that the model is adapted to each country with updated detailed data, which has not been possible within the framework of this study.

5.1.2 Composition of the car fleet

The size and design of the registration tax also affects the composition of the car fleet. Even though a number of other, country-specific conditions influence what car the consumer chooses.

Below examples of the effects which might be achieved by restructuring the registration tax and the ownership tax in Denmark are shown. The examples indicate the magnitude of effects we can expect by restructuring the tax based on a Danish context. Such changes can, in principle, be carried out in all the Nordic countries. The precise effect will however vary between countries due to, among other factors, different purchasing power of consumers.

5.1.3 Example A, the registration tax is abolished

The table below presents two model calculations. Both are estimated by use of the Car Choice Model (2002), modified with 2008 data. The top line represents the situation with no changes, that is, the situation represented as the average car in the reference situation (average car with no changes). The next line shows the results of example A, when the registration tax is completely removed.

Table 5.3 Results from Example A, values for the average new car in DKK

<table>
<thead>
<tr>
<th>Diesel share</th>
<th>CO2 per km</th>
<th>Reg tax</th>
<th>Owner tax</th>
<th>Net weight</th>
<th>Price</th>
<th>Tax and VAT</th>
<th>km/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unchanged reg tax</td>
<td>46.5%</td>
<td>147</td>
<td>127,020</td>
<td>2,763</td>
<td>1,193</td>
<td>244,582</td>
<td>94,049</td>
</tr>
<tr>
<td>Scenario A</td>
<td>46.8%</td>
<td>152</td>
<td>0</td>
<td>2,976</td>
<td>1,230</td>
<td>124,823</td>
<td>99,858</td>
</tr>
</tbody>
</table>

Source: COWI Car Choice model

The table shows average values for the sale of new cars sold in Denmark in the present situation and in case of abolishment of the registration tax. For example, the average registration tax for a new car amounts to DKK
127,000 per car in 2008 as the starting point. Removing the registration tax will bring the average car price down from DKK 244,582 to DKK 124,823.

The elasticities in the model are controlled against more recent elasticities in the Car Purchase Data (2007–2008), a model completed by DTU Transport. A comparison shows that the important elasticities related to changes of the ownership tax are on the same level in the two models, supporting the results of the Car Choice model, which use elasticities that are 7–8 years old. The model is also updated with new car data from 2007. Furthermore, the shares of diesel cars and private/company cars are calibrated so they match 2008 data from Danish Statistics. Finally, actual 2010 fuel prices are used.\(^\text{17}\)

The model shows that abolishment of the registration tax in Denmark would result in larger cars and cars that use slightly more fuel. This would result in an increase in the CO\(_2\) emission of 5 grams per kilometre, equivalent to 3.5%. With the current structure for the ownership tax in Denmark, the increased emission per kilometre implies that the average annual circulation tax would increase slightly. When we compare with Sweden today, where there is no registration tax, we find that the car ownership will be close to that in Sweden, but that the new cars sold in Denmark in average would be smaller than those sold in Sweden.

5.1.4 Example B, annual circulation tax is abolished

Every line represents a model calculation, here indicating the significance of the annual circulation tax. The top line represents the situation with no changes, i.e. the average car without changes in the circulation tax. The next line shows the result, i.e. the situation where the circulation tax is abolished.

<table>
<thead>
<tr>
<th>Table 5.4 Results from Example B, values for the average new car in DKK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel share</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Unchanged owner tax</td>
</tr>
<tr>
<td>Scenario B</td>
</tr>
</tbody>
</table>

Source: COWI Car Choice model

The table shows average values for the new car sale in Denmark. The average registration tax is estimated to DKK 127,020\(^\text{18}\) per car in the starting point in 2008. By a reduction of the circulation tax as, the model estimations result in an increase of the average registration tax from DKK 127,020 to DKK 132,344. This indicates that larger and more expensive cars are bought if the circulation tax is abolished. The share of diesel cars will increase from 46.5% to 50.6%.

\(^{17}\) See appendix 9.1.1.

\(^{18}\) Note that the calculated registration tax is exclusive of tax deduction for safety equipment.
Despite the increase in the share of diesel cars, the elimination of the circulation tax will result in the purchase of larger and slightly more fuel consuming cars. In this way, the elimination of the ownership tax results in an increase in the CO₂ emission of 2 grams per kilometre, equivalent to 1.5%.

Assumptions etc. are shown in Appendix 2.

5.1.5 Size of the car fleet

The examples above also cover a growth of the car fleet, which is not reflected in the table. The relatively small increase in the average CO₂ emission for new registered cars by abolishing particularly of the registration tax covers several simultaneous effects:

- Some consumers will buy larger and more CO₂ emitting cars if the registration tax is abolished as these have become significantly cheaper
- Some consumers will buy a car or buy more cars than usual, e.g. households which otherwise would not have bought a car, and households which buy car number two. In both cases, the cars in question will often be relatively small and have relatively low CO₂ emission per kilometre

The net effect of this is, according to the estimations in the Car Choice Model, a relatively limited increase in the average CO₂ emission from newly registered cars, but an enlargement of the whole car fleet. As a result, the traffic volume and the total CO₂ emission increase significantly, if other moderating taxes are not introduced simultaneously, for example road charges.

5.1.6 Conclusion

Registration taxes affect the CO₂ emission from the Nordic car fleet. The effect varies between the countries, and is influenced by other parameters such as tradition, geography and economic ability. This naturally complicates the comparison across countries.

Estimations based on Danish conditions show that a reduction of the registration tax will increase the car sale and the car ownership. It indicates a price elasticity on cars of around -0.6. Whether similar elasticities are valid in the other Nordic countries is not assessed but we see no reason that elasticities at similar level should not be expected.

The examples of an abolishment of the high Danish registration tax and the annual ownership tax show a very small increase in the CO₂ emission from passenger cars. The reduced consumer costs leads to the purchase of more cars – in a combination of small and large cars – leading to almost the same average CO₂ emission per km, but a larger car fleet. These calculations
have focused on the tax rate – not on the design. In Hypothesis 5 about successful restructuring, we look at differentiation of the taxes after the cars’ CO$_2$ emission.

5.2 Hypothesis 2, company cars

*Company car schemes in the Nordic countries provide incentives for large cars and increased driving because of subsidies and the focus on these goods. The hypothesis is that all the Nordic countries have indirect subsidies on company cars which increase the CO$_2$ emission.*

Company cars concern passenger cars, which are financed by companies and available to the employee during working hours as well as for private purpose.

The effects of the different company car schemes in the Nordic countries are difficult to compare because of the many different parameters of the schemes. Copenhagen Economics has conducted an analysis of European company car schemes in 2010 among other things to assess whether there overall is a subsidy embedded in the company car schemes.

The survey includes Sweden, Finland and Denmark and concludes that there are distorting subsidies and that these subsidies result in substantial welfare economic losses of up to 0.5% of GDP. In Denmark, Sweden and Finland subsidies are larger, the more expensive the car. This creates an incentive to buy more expensive – and thus more CO$_2$ emitting cars than usual. According to the survey, in Denmark, Sweden and Finland the subsidy part is around 10–20% of the total costs. Below is shown a couple of the main conclusions from the Copenhagen Economics analysis, indicating that the Nordic countries have a relatively low subsidy element compared to other EU countries, and that the more expensive car classes are common as company cars.
Table 5.5. Subsidy element in different countries' company car schemes.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A: Subsidy up to 10%</td>
<td>Finland, Poland</td>
<td>Poland</td>
<td>UK</td>
</tr>
<tr>
<td>Group B: Subsidy 11-20%</td>
<td>Denmark, Sweden</td>
<td>Denmark, Finland, France, Netherlands, Sweden, UK</td>
<td>Denmark, Finland, France, Netherlands, Sweden</td>
</tr>
<tr>
<td>Group C: Subsidy 21-30%</td>
<td>France, Luxemburg, Netherlands, Spain</td>
<td>Austria, Luxemburg, Slovenia, Spain</td>
<td>Czech R., Germany, Italy, Luxemburg, Slovenia, Spain</td>
</tr>
<tr>
<td>Group D: Subsidy more than 30%</td>
<td>Austria, Belgium, Czech R., Germany, Greece, Hungary, Italy, Portugal, Slovakia, Slovenia, UK</td>
<td>Belgium, Czech R., Germany, Greece, Hungary, Italy, Portugal, Slovakia</td>
<td>Austria, Belgium, Greece, Hungary, Portugal, Slovakia</td>
</tr>
</tbody>
</table>

Source: Copenhagen Economics.

Note: Norway and Iceland are not included in the table. As shown in Fig. 5.1, the more expensive cars constitute the larger share of the company cars.

The company car schemes affect the CO$_2$ emission from passenger cars in several ways:

- **The size of the company cars**: company cars are typically larger than the average new car sold on the Nordic markets. This affects the car fleet, and in particular, the composition of the total car fleet.
- **The share of company cars**: Company cars affect the composition of the passenger car fleet.
- **Larger driving volume**: Company car schemes are typically accompanied by a subsidy to the use of the car, including fuel, which reduces the economic incentive to limit driving.

5.2.1 The size of the company cars

The analysis from Copenhagen Economics 2010 shows that there is a subsidy element in the Nordic taxation schemes for company cars of 10–20%.
This, and possibly a request for the cars to be presentable, means that cars sold as company cars on average are larger than other cars, while there is no expectation of a substantial increase in the total car sale.

91% of the Swedish produced cars, which are sold in Sweden, typically Volvo, are sold as company cars. The figure below shows the weight of private versus company cars in Sweden in 2004.

Figure 5.2 Weight of company cars vs. private cars in Sweden, 2004.

The figure below shows that company cars in Finland on average have larger engines measured by cylinder volume than private cars.

Figure 5.3 Cubic capacity in cm³ in company cars vs. private cars in Finland, 2004.

Nordania Leasing, who leases cars for Danish companies, informs\(^{20}\) that company cars in Denmark through the years have increased in size to a level corresponding to the large middle class car. Ford Mondeo is the preferred car while other cars such as large versions of VW, Opel, Peugeot, Volvo and Audi are also popular. There is almost no communalities with the top 10 of private cars. The latter are smaller cars, such as Toyota Avensis and there are nearly two car classes of difference. Nordania explains this by the competition on the car market which has triggered strong competition on campaign cars, meaning that companies can move up a car class without significant extra costs.\(^{21}\)

**Box 5.1 Example: Most usual cars in the new car sale in Denmark**

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 10 passenger cars sold in Denmark in 2008:</td>
</tr>
<tr>
<td>Only Kia Ceed, Audi A4 and VW Passat exist on both lists, so there seems to be very different dynamics and decision processes in play. The lists also confirm that company cars are dominated by the heavier car types.</td>
</tr>
</tbody>
</table>

Source: Danske Bilimportører, Statistik.

The experience of obtaining a “benefit/discount” via for example a company car scheme is very strong and motivating for many. Company cars also have a signal value to the surroundings often favouring larger cars.

In Denmark, the value of the car, which is taxed when the car is in use as company car, is always set to minimum DKK 160,000. This means that car owners are penalized through the tax, if they choose a smaller car.\(^{22}\) There are favourable tax rules for company cars over three years of age (in practice two years and one month).

### 5.2.2 The share of company cars in the car fleet

The share of company cars vary among the Nordic countries. The share represents from 6% in Sweden to 11% in Norway of the total passenger car fleet.\(^{23}\)

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\(^{20}\) See e.g. [http://www.nordania.dk/da-dk/nyheder-og-presse/Pages/Nyheder-og-presse.aspx](http://www.nordania.dk/da-dk/nyheder-og-presse/Pages/Nyheder-og-presse.aspx)

\(^{21}\) According to Henrik Friis Mortensen, Regional Director, Nordania Leasing.


\(^{23}\) Source: TemaNord 2008-587.
However, company cars have great importance to the composition of the car fleet as a very large part of the cars are bought as company cars and sold after some years as private cars with a remaining life expectancy of 12–15 years. The 2008 company car sale represented 30% of new car sales in Denmark, 44% in Finland, 60% in Sweden\textsuperscript{24} and around 41% in Norway in 2010.\textsuperscript{25} The share vary from year to year, but company cars are a very important part of the car fleet’s food chain as 30–60% of the car fleet are “born” as company cars. As the cars are relatively large, company cars can be expected to have an even longer life expectancy than the (smaller) cars which are bought as private cars.

Thus, the incentives of the company car schemes play an important role for the composition of the car fleet in the long run.

5.2.3 Transport volume in company cars

There is full or partial subsidisation of the variable costs of driving in a company car. The Nordic countries have different rules, when it comes to fuel used for company car driving and the taxation hereof. Denmark has the lowest income taxation of company car fuel, and Finland has the highest.

The tax rules for company cars in Sweden imply that the employee pays 60% of the normal fuel price.\textsuperscript{26} In Denmark, fuel costs are normally included in the company car package.

\textsuperscript{24} Copenhagen Economics 2010. Company car taxation subsidies, welfare and environment, for the European Commission.
\textsuperscript{26} TemaNord 2008:578.
In Norway, the employer pays the maintenance of the car, the insurance and the annual taxes. The consumption of fuel is included in the employer paid tax. The employee pays parking and road toll.27

For electric and hybrid cars in Norway and Sweden the company car tax base are reduced compared to similar cars using conventional fuels. In Norway, the tax is reduced with 40% compared to a similar car on ordinary fuel.28 This is expected to promote a greener car fleet. Norway and Sweden does have a share of cars on alternative fuel in the company car fleet, but it remains small compared to the total car fleet.

With reduced or zero variable costs there will be an incentive to drive more in company cars than in private cars. However, there are no useful statistics or data on the driving volume for company cars and private cars respectively in the Nordic countries.

The Danish Tax Ministry informs that company cars drive more kilometres annually than the average car and therefore contribute significantly to the CO2 emission from the transport sector.29

5.2.4 Tendencies and sensitivity

The governments of the Nordic countries have taken different initiatives in recent years to tighten up the company car schemes. In Denmark, there is a tax increase from 2010, where an environmental fee equivalent to the annual ownership tax is imposed on company cars.

In Norway, there is a tax discount on electric cars used as company cars. It is less expensive to have an electric car as company car than a conventional car.30 This also applies to Sweden, where electric, hybrid and gas cars are only taxed by 60% of the value for similar conventional cars, but with a maximum of SEK 16,000 in annual discount. Ethanol cars as company cars are taxed by 80% of the value for a similar car, but to a maximum of SEK 8,000 in annual discount.31

In 2010, the economic crisis has caused a boom in the sale of small company cars in Denmark. The tendency towards smaller company cars started a couple of years ago but has been enhanced significantly in 2010.32 New figures from The Danish Car Importers33 show that smaller cars such as Peugeot 206, Citroën C3 and Toyota Yaris are now the first choice for almost every fourth company car driver. A couple of years ago it was every seventh.34

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27 Source: Answers to questionnaire.
28 Shown in the source above.
29 Source: The Tax Ministry’s web page, skat.dk
30 Source: Answers to questionnaire for Norway, July 2010.
31 So far, the discounts apply in until ultimo 2011, according to www.skatteverket.se/skatter/arbejde inkomst, August 2010.
32 Opinion from Sales Manager Nicolai Blumensaadt from the company Autolease, specialized in long term renting of company cars.
33 De Danske Bilimportørers hjemmeside.
34 Besides “Danske Bilimportører”, see also the article: http://politiken.dk/erhverv/article65426.ece
Because of simultaneous price increases on the larger middle class cars, many now choose a lower car class.\(^\text{35}\) In addition, a tax must be paid from January 2010 of the annual green ownership tax, which is differentiated according to the CO\(_2\) emission.

The rapid changes in company car choices suggest that the market for company cars is sensitive and tax susceptible. Tax restructuring can therefore be expected to have a great impact.

The following example shows that companies act on economic incentives to save money. “Split leasing” is a new Danish model, where the employer and the employee lease the car together.

**Table 5.6 Split leasing, example in DKK**

<table>
<thead>
<tr>
<th></th>
<th>Employee</th>
<th>Employer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial rate</td>
<td>3,750.00</td>
<td>15,000.00</td>
</tr>
<tr>
<td>Monthly rate</td>
<td>2,358.00</td>
<td>9,430.00</td>
</tr>
<tr>
<td>Monthly VAT deduction</td>
<td>-839.00</td>
<td></td>
</tr>
<tr>
<td>Monthly net costs</td>
<td>2,358.00</td>
<td>8,591.00</td>
</tr>
<tr>
<td>Of which car</td>
<td>1,630.00</td>
<td>5,680.00</td>
</tr>
<tr>
<td>Of which standing costs</td>
<td>728.00</td>
<td>2,911.00</td>
</tr>
<tr>
<td>Monthly tax of company car.</td>
<td>4,240.00</td>
<td></td>
</tr>
<tr>
<td>Annual saving (1/48 of DKK 3,750)</td>
<td>21,650.00</td>
<td></td>
</tr>
<tr>
<td>Deducted monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company saving expressed as private costs element</td>
<td>29,225.00</td>
<td></td>
</tr>
</tbody>
</table>


Note: Estimated by Danish Split Leasing for Ford Mondeo 2.0 TDCI DPF Econetic station car. Km. private: 10.000 km, business: 40.000. Duration: 48 months. As driven kilometres are settled in arrears, the employer is charged a deposit of 4,800DKK and the employee a deposit of 19,200DKK when establishing the agreement.

In Norway, the market for company cars has also been developing in 2009–10. Marius Paus, who is Market Director of the country’s largest actor in car leasing, LeasePlan Norway, says in an interview in August 2010:

“The companies often wish to keep an environmental equilibrium and choose the new car models with low CO\(_2\) emission, cars with low fuel consumption. But the actual size of the cars preferred by the Norwegian company car users has not changed much.”

Among the most popular leasing cars are station cars such as VW Passat and Volvo V70. Especially with the new, emission friendly diesel engines, Volvo V70 has had a powerful boost as a leasing car.

\(^{35}\) In “Firmabilanalysen 2010” from bilpriser.dk, it is stated that fuel economic cars are the most economic choice, - but you still save relatively most on the most expensive cars.
- Up to 90 percent of the car users chose station cars when they need to acquire a new leasing car, which is connected to the Norwegians’ leisure activities and not least that many Norwegians have cabins in the mountains or by the sea,”

“We have relatively many Toyota Prius in our car fleet, here we have seen a sharply increasing trend over the past year. It is easy to sell as a used car. The electric cars are also increasing, this accounts for both Buddy and Think. I also have a certain faith in the electric Nissan Leaf, when it comes on the market in a short while. ”

5.2.5 Conclusion

The Nordic company car schemes contain a subsidy element of 10–20% and have a substantial impact on the composition and use of the passenger car fleet:

- The cars typically bought as company cars are 1–2 classes larger than the private cars and in average have larger CO₂ emission per kilometre
- Company cars represent a very large part of the car fleet basis as 30–60% of the new cars in the Nordic countries are purchased as company cars and then transferred to private cars after a few years. A very large part of the cars in the car fleet are thus born as company cars
- There is a full or partial subsidy on operating costs for company cars, including fuel, such that variable driving costs are low or close to zero for the user. This must be assumed to cause higher driving volume, but there are no useful data on this for the Nordic countries

The company car market is thus a key factor in the composition of the car fleet. At the same time, it is a relatively sensitive market, where changes in rules and frames, including perhaps also societal attitudes, can affect the companies’ decisions quickly, ensuring a rapid breakthrough.

5.3 Hypothesis 3, packages

*It is essential for the effect that taxes, costs and options are clear to the consumers. Broader packages with a specific CO₂ element are more effective than general tax increases.*

Within energy savings generally it is recognized that economic instruments often work best, if they are backed by campaigns and information that make the advantages clear to the consumers and at the same time reduce any uncertainties.

It is also recognised that broader packages can make it easier to overcome resistance/barriers than single initiatives.
In existing studies on the reduction of CO₂ from the transport sector, for example from the Danish Traffic Ministry, it turns out that “packages” increase the efficiency and reduce the costs compared to single initiatives. In a study from Nordregio 2009, it is argued that drivers’ CO₂ emission is not only determined by economic instruments but also by physical planning, efforts in behavioural change, investment in public transport such as metro, for example law changes and “going in front”. It is concluded that it is important with a mix of instruments.

Stockholm is identified as a positive example that tax increases – tolls – accompany investments in the public transport system.

Another point in the study is that it is important to ensure the maximum effect of the instrument that the perception/understanding of the instrument is evaluated, and that a potential adjustment is made accordingly. Evaluations of how and why people react as they do in terms of car transport and car choice do not seem to be of high priority in the governments of the Nordic countries.

5.3.1 Examples of efficient packages

Packages of taxes/tax exemptions and other instruments can be cost-effective and cause effects such as CO₂ reduction that exceeds the effect of a single initiative. However, it is essential that packages are dosed, so they do not get unnecessarily expensive or less efficient than the effect of a single initiative. This can happen if the package gets less transparent, have many indirect measures, cannot easily be adjusted or have overlapping measures that increase the costs for a certain CO₂ reduction. The latter may have been the case in Sweden where there are incentives to buy “miljøbilar” even without the extra subsidy “miljøbilsprämien.”

Below are some examples of efficient packages in the Nordic countries.

Norway is the country with most electric cars (3028) and the country with most advantages for electric cars.

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38 Conclusions based on Internet searches in August 2010.
39 Correspondence from the Swedish Environmental Agency, Naturvårdsverket, 16 November 2010, Ulrika Lindstedt.
40 The below list is from: http://gronnbil.no/spoersmaal-svar/om-ladbare-biler-og-infrastruktur-article-23-449.html#18
A comparative analysis of taxes and CO₂-emissions

- Exemption from registration tax
- Zero rate of value added tax on purchase
- Strongly reduced annual tax
- Free parking on municipal parking lots
- Exemption from road toll
- Access to drive in the lane for public transport
- Exemption from car tax (not passenger tax) on domestic ferries
- Higher rate of driving allowance when using the car in the public sector – 4NOK/km instead of 3.50NOK/km
- Basis for company tax is only 50% of the car’s value
- Especially in Oslo and Askerhus the city government has taken initiatives to sell electric cars as a good “package” with all the mentioned advantages

In August 2007, a toll was introduced in Stockholm, and it is estimated that the driving volume in inner Stockholm, as a consequence of the toll, has decreased by around 15%.²¹ As part of the toll package all green cars, i.e. ethanol, gas, electric and hybrid cars are exempted from the toll.

In 2009, 2,500 Toyota Prius were sold in Sweden. Basically, none were sold in Denmark, where the Prius is not treated as a “green car” and favoured with special advantages. In Stockholm, the green cars including Prius are also exempted from parking fees.²² In Sweden, almost four of ten cars sold last year were green cars.²³ There are now around 330,000 green cars in Sweden.²⁴

Denmark, Finland and Iceland are not working on a broad “green car concept” as Sweden and Norway. However, Copenhagen has for many years worked on a toll ring as part of a larger traffic package in the capital.

Denmark, Iceland and Finland have very few cars on alternative fuel compared to Norway and Sweden, which have obvious “green car packages” (see table on this in Appendix 1).

In the report from the OECD on green growth strategy²⁵ it is stressed that there is a need for packages if the CO₂-tax cannot be designed optimally, but at the same time it points to the need for policy packages which directly

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²² http://www.berlingske.dk/koebenhavn/bompenge-kan-give-flere-miljoebiler
²³ Almost four of ten cars sold in Sweden are green cars – even though the market for green cars have been saturated compared with the preceding year. According to the car manufacturers’ organisation Bil Sweden, the share of green cars of newly registered cars is above 40% in two regions (län) in the first five months of 2010: Gotland with 42.1% of green cars and Västra Götaland with 41.8%. Blekinge comes in third with 39.5%, Östergötland is fourth with 39.0% and Stockholm is fifth with 37.0%. However, a look at the share of green cars of the car fleets of Swedish municipalities gives an entirely different picture. This is revealed by the new municipal ranking made by the lobbyists Gröna Bilister (Green motorists). In 73 of the 146 Swedish municipalities taking part in the survey, more than 40% of the car fleet consist of green cars. Two municipalities only have green cars – Knivsta and Laxå, closely followed by Uddevalla with a 99% share of green cars. On average, the green cars hare in Swedish municipalities is 54% compared to 19% five years ago. http://www.nyteknik.se/nyheter/fordon_motor/bilar/article2439565.ece
affects the supply and the car production itself. It may prove effective also to target car manufacturers to supplement CO₂ taxes on cars and transport which affect the demand side with supply side measures.

5.3.2 Conclusion

Packages are good at providing transparency. Transparency is treated further in the next hypothesis. As it is seen in Sweden and Norway packages also contribute in giving a seal of approval/quality stamp of specific car models.

In a package, weight is put on working on a behavioural change, which is necessary – in addition to what the price signal alone dictates. For some environmentally efficient cars there will be a variety of psychological/knowledge based barriers and lack of safety, which will be too expensive to overcome with economic instruments alone.

There are options for further development of package solutions for car owners in the Nordic countries. Different guaranties can be set up to avoid fear or perceived risk when purchasing cars based on less known technology. Active cooperation with the industry in various areas may be initiated to launch inexpensive campaign models which can be bought/promoted by for example the government.

As seen in the examples elements as accessibility and parking are essential to the consumer and may be included in packages.

Barriers may exist towards purchasing cars based on less known technology. Any barriers to the consumer may be outweighed by advantages of a package, adjusting the consumer’s overall picture so that it becomes positive and the CO₂ effective car appears attractive.

In the Nordic countries and especially in the Danish car market leasing packages have become very popular. It may also be considered whether the state can support leased green cars as a part of the package solution.

If a study based on surveys and interviews was undertaken it would be possible to estimate in the actual use of the environmental friendly cars compared to the more energy consuming ones. This would also be an important result when looking at the success of a certain package. As will be shown later in the report the total number of “miljøbilar” as part of the total car stock is still relatively small, because their availability and popularity is recent, but this is likely to change in the coming decade.

5.4 Hypothesis 4, transparency

The tax instrument has been very important in the introduction of new car types such as electric and hybrid cars in the Nordic countries. Visibility and political support seem to be important supplements.
The core of the hypothesis is that it will be possible to achieve greater CO\textsubscript{2} reductions by increasing the visibility of existing taxes, and/or of new CO\textsubscript{2} tax initiatives.

*Annual taxes* that reflect the CO\textsubscript{2} emission affects the composition of the car park in favour of cars with lower CO\textsubscript{2} emission. In all the Nordic countries, the annual tax is today more or less related to the CO\textsubscript{2} emission. In Denmark and Norway, the annual taxes can be quite large, up to DKK 18,500 per year for gasoline cars and for diesel cars from DKK 160 to DKK 25,000 per year depending on CO\textsubscript{2} emission. High annual taxes are a mere extra cost for the consumer. Total annual costs including taxes, fuel costs and maintenance are simple to estimate. However, often such information is not provided in a transparent way, as indicated in the example below on the Danish car scrapping premium.

### 5.4.1 Danish car scrapping premium

Denmark has a low scrapping premium, but in 2010 it has been considered to introduce a higher scrapping premium of DKK 15,000, to be disbursed when the old car is scrapped and replaced by a new, green car. In this context, a number of owners of old cars have been asked whether they want to use the new system, and most answered that they could not afford to buy a new green car. This shows a lack of transparency of the taxes and costs carried by car owners, as a new, energy effective car may be the most economic choice. The following calculation examples provide some indication about the price difference in driving an old 1997 model or a new environment friendly and reliable car. If loan financing is needed for the old cars, they become even more expensive. On the other hand, if maintenance/repair is not needed costs will be slightly lower. If the car is not used much, the relative advantage in buying a new car becomes smaller. In the examples, the new cars are somewhat smaller, but safer. If a new car is bought and financed by the dealer over six years, the owner will after the six years have a car that represents a significant value.
Annual private economic costs in Denmark for Nissan Pixo, 4 doors:

Total price incl. VAT: DKK 89,990, Financed per year\(^{46}\) around DKK 14,000.
Annual taxes = DKK 520.
Fuel costs for 20,000 driven km: 20,000*10/22.7 = DKK 8,810
Total: 23,330 DKK/year\(^{47}\)

Annual costs in Denmark for Smart, 2 persons:

Total price incl. VAT 99,990 DKK, Financed per year = around DKK 15,000.
By 6-year loan at dealer = 18,000 DKK/year + 5,000 DKK extra in down payment\(^{48}\)
Annual tax = 520 DKK/year
Fuel costs per year: 20,000*10/30 = DKK 6,666.
Total/year = 22,186 DKK/year
Total/year =25,186 DKK/year, by 6 year financing by dealer

1997 model, Fiat Bravo, no loan in the car.

Annual tax: 6,480 DKK/year
Fuel costs per year: 20,000*10/9.7 = 20,618 DKK/year
Maintenance 7,000 DKK/year
Total = 34,098 DKK/year

1997 model, Opel Astra, no loan in the car

Annual tax: DKK 5,500.
Fuel costs per year: 20,000 km*10/10.4 = 19,230 DKK/year
Maintenance 5,000 DKK/year
Total= 29,730 DKK/year

Source: Dealers’ web pages and The Danish Road Directorate “How far on the litre 2010”. Insurance Expenses are not included.

The example shows that the car taxes in Denmark from an economic perspective will have greater effect, if more information about consumer costs is provided, either from the government or from the industry.

The cars with highest annual tax in Denmark are typically company cars. The annual tax can be considerably higher than shown in the example above – up to 25,000 DKK/year. As a new feature, company car tax is from 2010 also calculated from the green ownership tax. This can have an effect, but it is still too early to say how large this effect will be.

When car producers and importers choose to send environment friendly cars on the different markets depends on how attractive the markets are considered to be. Other conditions also have importance, as the following ex-

\(^{46}\) Down payment approx. 20%, i.e. scrapping premium, - Car loans in banks with a loan period above 10 years at 6% = DKK 14,000/year. Real estate loans or mortgage loans are even cheaper.

\(^{47}\) There is a minimum a three-year warranty on the car, for which reason any particular maintenance costs have not been included.

\(^{48}\) See financing offer for Smart in Appendix 3.
ample with the Nissan Leaf shows. Nissan Leaf represents a new type of electric car of which a significant sale in the coming years is expected.

Case example: Nissan Leaf introduction plan in Europe.

From Nissan Denmark we have received following information about the introduction plan for their newest electric car, Nissan Leaf: “As starting point the car is launched across Europe in 2012. In places with attractive conditions for electric cars it is introduced earlier. This applies to Great Britain and Holland among others. Whether Leaf will be introduced earlier in Denmark depends on the Danish authorities,” it is said.49

Or in other words: Nissan does not regard Denmark as having particularly attractive conditions for electric cars and therefore bides the time before launching the car in the country even though Denmark has a registration tax relief on electric cars.

In June 2010 a total of 19,000 Leaf cars were pre-booked, which goes to show the great interest in the model.50

5.4.2 Labelling cars

In 2010 the European Parliament studied the consumer information provided regarding fuel economics and CO₂ emissions from new passenger cars in a number of EU countries.51 The main conclusions are that the general “posers/energy labelling”, that dealers are obliged to make have low relevance to the consumer, and the report recommends that it should be mandatory to have clear on-line guidance across car brands.

It is also suggested that all the operation costs and taxes on the car during one and three years are summarised and made transparent to the potential buyers. This should be a supplement to the more abstract km/l, which many customers do not necessarily understand the full implications of.

It is also made clear in the analysis that Finland (and the UK) has gone the furthest in this direction. In Finland for example, annual expenses to fuel when driving 18,000 km/year are estimated. In Finland, it was also considered to make a summary about the costs over a three-year period, but it was considered problematic, as taxes and prices fluctuate.

The study finally calls for launching surveys of what actually works in relation to the consumers (data on this are lacking today), and it is recommended that sales staff have a compulsory course in informing about the environmental aspects of the car during a sale.

49 In e-mail of 27 August 2010 from Tor Jensen, Nissan Customer Service Centre, Nissan Nordic Europe Denmark.
50 Leaf has a scope of around 160 km on a charge and a top speed of 140 km/t according to http://miljoaktuellt.idg.se/2.1845/1.325212/nissan-leaf-slutsald
Figure 5.5 below shows examples of energy labelling of passenger cars in Denmark and Finland. The Danish template for passenger cars and vans came into force from January 2010, and the Finnish label is found on the dealer’s website 1 September 2010.

![Energy Labelling of Cars in Denmark](image)

**Figure. 5.5 Energy labelling of cars in Denmark.**

*Source: The Danish Road Directorate 2010.*
The calculation of the fuel taxes/costs and the annual taxes look quite the same in these two labels. Note however, the significant difference in the definition of the energy classes. In the Danish case the specific limits of the different classes is not presented as opposed to Finland. In Finland there are more stringent demands to a class A car. The Danish classes are based on km/l and not on g CO$_2$/km.
Table 5.7. Danish energy classes in labelling of passenger cars 2010

<table>
<thead>
<tr>
<th>Danish energy classes/band</th>
<th>Gas km/l</th>
<th>Diesel km/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>18.2–op</td>
<td>20.5–op</td>
</tr>
<tr>
<td>B</td>
<td>15.4–18.1</td>
<td>17.3–20.4</td>
</tr>
<tr>
<td>C</td>
<td>14.3–15.3</td>
<td>16.1–17.2</td>
</tr>
<tr>
<td>D</td>
<td>12.5–14.2</td>
<td>14.1–16.0</td>
</tr>
<tr>
<td>E</td>
<td>11.8–12.4</td>
<td>13.2–14.0</td>
</tr>
<tr>
<td>F</td>
<td>10.5–11.7</td>
<td>11.9–13.1</td>
</tr>
<tr>
<td>G</td>
<td>4.5–10.4</td>
<td>5.1–11.8</td>
</tr>
</tbody>
</table>

Source: The Danish Road Directorate.

Note: Diesel emits 12–15% more CO_2 than gas per litre.

Norway is not covered by the energy labelling directive. However, CO_2 emissions are clearly stated on the dealers’ web sites for new cars. Sweden and Norway have in addition a special “Green Car Class” for cars that emit below 120g CO_2/km.

Finally, there may be problems with lacking visibility of the advantages in public transport as well as the conditions and investments. Especially in Denmark this is apparently a problem according to expert assessments in the box below.

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Bus traffic has lots of success – just not in Denmark

“ Massive and persistent decline in public bus transport everywhere in Denmark over the past ten years. Why is it going so badly in Denmark, when bus transport is booming in Sweden, Norway, Germany and France?”

What creates prosperity in public transport and thereby also the bus transport is improved accessibility for the busses in the city and the consequently reduced travelling time. This is shown in all preference analyses. Such improved accessibility in the metropolitan area is not achieved without large investments and focused political prioritizing of bus transport at the expense of car traffic,” Mathias Sdun explains.

In Copenhagen, the bare fact is that almost every radial road is faster by car than by public transport, including the bus, if you want to reach the city centre as fast as possible.

Apparent efficiency of bus lanes etc. exists in Sweden and Norway, and the conclusion of the article is that the government must take action to ensure the correct societal prioritization.

“The municipalities often fall for the temptation to cut investments in public transport and instead direct them towards more popular areas such as the schools,” Christian Wichmann Matthiessen says.

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52 According to the weekly magazine Ingeniøren (The Engineer), July 2010, http://ing.dk/artikel/110203-bustrafikken-bar-masser-af-succes-bare-ikke-i-danmark
53 Section Leader in Movia, same source as above.
54 Professor, geography and member of the infrastructure commission set up by the government, same source as above.
In addition, the Danish prices on alternatives to the car have risen significantly. A typical Danish family with two children in day-care and kindergarten, who uses public transport daily, paid in 2007 DKK 13,000 more for public transport than in 2001. If the services had only risen with consumer prices, they should only have paid 6,500 DKK more.\(^{55}\)

From 1999 to 201, the cost of travelling by bus or train in Denmark has increased by 58%\(^{56}\). Costs of travelling by car have increased 45%\(^{57}\). In Sweden, a number of organisations have joined forces to double the share of public transport of the annual passenger transport, and a number of bus companies have already drawn up strategies for attaining this goal.\(^{58}\)

In Finland, improvements are being made to the train and metro infrastructure in Helsinki.\(^{59}\) In Copenhagen, a metro extension is due to open in 2017.

5.4.3 Conclusion

Evidence suggests that there can be major CO\(_2\) gains from increased visibility of the existing taxes and issues related to green transport.

In Finland stringer CO\(_2\) norms must be met to become a class A car than in Denmark, and the requirements in Sweden and Norway is in between. From January 2010, tightening rules for energy labelling has been introduced in Denmark to increase its visibility and importance in marketing. When over 40% of newly purchased gas and diesel cars in Denmark are in the class A segment in 2009,\(^{60}\) it may be reasonable to consider whether there should be a tightening of classes, so the most efficient cars are appear clearly with its own class.

Dividing the classes in levels of CO\(_2\) emission will also be clearer to the consumers, if this now and in the future is a significant focus point – and already reported by dealers. However, Danish consumers must get used to the meaning of the labelling.

In Norway and Sweden there are well functioning web pages with “green car news”, in Stockholm a “green car barometer” etc. In Denmark there are no entities or organisations that clearly informs the consumers about how much they save by choosing the most energy efficient car in the class, for example on a 1, 3 and 5 year basis, how they can organise and share experiences etc. i.e. clear communication of the tax differences, which have existed since 2007.

Public transport prices in Denmark have increased rapidly in the past 10 years compared to that of passenger car transport. It is doubtful how clear


\(^{57}\) Source: Danmarks Statistik, FDM og Transportministeriet i Jyllandsposten 13 April 2010.

\(^{58}\) Kartläggning våren 2010, Svenskkollevittrafik.

\(^{59}\) http://www.hel.fi/hki/helsinki/en/Current

\(^{60}\) See Appendix 1.
this is to the consumer, but it weakens the competitive position of public transport.

5.5 Hypothesis 5, differentiated car tax according to CO₂ emissions

Reforms of the annual car tax and car registration tax in Norway, Denmark and Finland in 2007 have had a significant impact on CO₂ emissions.

Differentiated registration and annual circulation car taxes according to CO₂ emissions per km travelled are expected to influence the composition of the car fleet towards vehicles emitting less CO₂ more than taxes solely based on car value, weight or a similar measure. Historically, there has always been a relatively close relationship between car value and energy consumption, as expensive cars used to be heavier and more energy consuming than cheaper cars.

The relationship is becoming less evident, as new technologies emerge, such as hybrid cars, electric car and plug-in hybrid cars, and biofuels is introduced into the market, presumably emitting less CO₂ than fossil fuels. Varying the level of taxes according to CO₂ emissions is therefore considered a more efficient means of reducing CO₂ emissions from new cars.

5.5.1 Nordic tax reforms

In recent years, all Nordic countries have implemented tax reforms by which taxes are differentiated according to CO₂ emissions. The principles are briefly outlined in the box below.

<table>
<thead>
<tr>
<th>Country</th>
<th>Tax Reform Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>In Denmark, the registration and annual car tax system was reformed in 2007. The reform addresses both passenger cars and vans. - Additional tax of DKK 1,000 for each kilometre travelled below 16 km/l for petrol cars and 18 km/l for diesel cars (according to norms). - Tax reduction of DKK 4,000 DKK for each kilometre travelled above 16 km/l for petrol cars and 18 km/l for diesel cars. - In 2009, the average CO₂ emission from new petrol cars was 141g CO₂/km corresponding to approximately 17 km/l, while emissions from diesel cars was 137g CO₂/km or approximately 19.5 l/km. (See Appendix 1)</td>
</tr>
<tr>
<td>Iceland</td>
<td>Car tax reform at year-end 2007: - One-sixth reduction of the average car tax. - Linkage to CO₂ emissions according to the formula: car tax = value of taxation ( x ) (certified CO₂ emission (g/km):10 + 4) ( CO₂ )61</td>
</tr>
</tbody>
</table>

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61 http://www.tollur.is/display.asp?cat_id=918
A comparative analysis of taxes and CO₂-emissions

Norway
Tax differentiation in Norway (presently the highest differentiation of car registration tax in the Nordic countries) implies low taxation of cars emitting up to 100 g/km and high taxation of cars emitting more than 140 g/km. (source: TemaNord 2008:587). In 2009, the differentiation concept was further developed where vehicles emitting less than 120 g CO₂/km became entitled to a tax deduction of NOK 500 per gram of CO₂ below 120 g. Compared to the first six months of 2009, the same period in 2010 saw a doubling of purchases of cars emitting less than 120 g/km (14.7% rising to 30.1%).

Fresh figures from Norway show that the average CO₂ emissions from new passenger cars continue to drop. In May 2010, emissions averaged 140 g CO₂/km for petrol cars and 143 g CO₂/km for diesels, while the average for newly registered vehicles in August and September 2010 was 138 g CO₂/km.

Finland
The Finnish reform imposes a registration tax on vehicles emitting less than 60 g CO₂/km of 12.5% linearly rising to 48.8% for vehicles emitting more than 360 g CO₂/km. The system is technology neutral. From 2011, annual car taxes will be differentiated according to CO₂ emissions, ranging from between EUR 20 and 605/year. In the spring of 2010, average CO₂ emissions from new passenger cars was 148 g CO₂/km (see Appendix 1).

Sweden
Sweden has no car registration tax, however, since 2006 the annual car tax has been differentiated according CO₂ emissions, and green cars have been subsidised. Annual car taxes are low, but changes are foreseen in 2011. In the first six months of 2010, the average CO₂ emission from new passenger cars was 6.3 l/100 km (156 g CO₂/km) compared to 6.7 l/100 km (164 g CO₂/km) in 2009.

Lately, most European countries have seen a reduction in CO₂ emissions per km for new vehicles. The table below shows the development in the respective EU Member States. As can be seen, Finland and Denmark stand out by having achieved substantial reductions in the period from 2007 to 2008. Sweden has also achieved a reduction, albeit only half the size of reductions in Finland and Denmark.

The focus of Denmark and Finland on introducing tax systems based on CO₂ emissions probably contribute to explaining these developments. Even though tax reform measures differed between the countries and the point of departure of each country was entirely different, a similar impact on CO₂ emissions was observed. The pan-European association Transport and Environment (T&E) estimates that, while the economic crisis only affected new car sales to a limited degree in 2008, it fully hit the market in 2009. Further, T&E assesses that 2008 was in many respects an average year and

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62 Oplysningsrådet for Vejtrafikken, Norge 2010 på; http://www.ofvas.no/Forside/Nyhetsaker/Dobbelt+s%C3%A5+mange+milj%C3%B8biler+i+2010.9UFRvG03.ips
63 http://www.ofvas.no/PRESSEELDINGER/
64 The source is ACEA note, 20 April 2010. “Overview of CO₂ based motor vehicle taxes in the EU.”
65 Swedish Transport Administration: Climate barometer 2010 at; http://www.trafikverket.se/Privat/Miljo-och-halsa/Klimat/Klimatbarometer/ The climate barometer is updated on a monthly basis.
that the emergence of more energy-efficient cars cannot be attributed to the economic crisis alone.

Table 5.8 New car registrations and CO₂ emissions in EU Member States

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1 Portugal</td>
<td>215</td>
<td>138</td>
<td>144</td>
<td>-4.1%</td>
<td>1</td>
</tr>
<tr>
<td>2 France</td>
<td>2,037</td>
<td>140</td>
<td>149</td>
<td>-6.2%</td>
<td>4</td>
</tr>
<tr>
<td>3 Italy</td>
<td>2,162</td>
<td>145</td>
<td>147</td>
<td>-1.2%</td>
<td>2</td>
</tr>
<tr>
<td>4 Denmark</td>
<td>146</td>
<td>146</td>
<td>160</td>
<td>-8.3%</td>
<td>12</td>
</tr>
<tr>
<td>5 Malta</td>
<td>5</td>
<td>147</td>
<td>148</td>
<td>-0.6%</td>
<td>3</td>
</tr>
<tr>
<td>6 Belgium</td>
<td>536</td>
<td>148</td>
<td>153</td>
<td>-3.2%</td>
<td>5</td>
</tr>
<tr>
<td>7 Spain</td>
<td>1,045</td>
<td>148</td>
<td>153</td>
<td>-3.4%</td>
<td>6</td>
</tr>
<tr>
<td>8 Poland</td>
<td>392</td>
<td>153</td>
<td>154</td>
<td>-0.4%</td>
<td>7</td>
</tr>
<tr>
<td>9 Hungary</td>
<td>163</td>
<td>153</td>
<td>155</td>
<td>-1.0%</td>
<td>10</td>
</tr>
<tr>
<td>10 Czech Republic</td>
<td>134</td>
<td>154</td>
<td>154</td>
<td>0.1%</td>
<td>8</td>
</tr>
<tr>
<td>11 Slovenia</td>
<td>71</td>
<td>156</td>
<td>156</td>
<td>-0.3%</td>
<td>11</td>
</tr>
<tr>
<td>12 Romania</td>
<td>285</td>
<td>156</td>
<td>155</td>
<td>0.7%</td>
<td>9</td>
</tr>
<tr>
<td>13 Ireland</td>
<td>151</td>
<td>157</td>
<td>162</td>
<td>-3.0%</td>
<td>13</td>
</tr>
<tr>
<td>14 Netherlands</td>
<td>481</td>
<td>158</td>
<td>165</td>
<td>-4.2%</td>
<td>15</td>
</tr>
<tr>
<td>15 Austria</td>
<td>294</td>
<td>158</td>
<td>163</td>
<td>-2.9%</td>
<td>14</td>
</tr>
<tr>
<td>16 UK</td>
<td>2,084</td>
<td>158</td>
<td>165</td>
<td>-4.0%</td>
<td>16</td>
</tr>
<tr>
<td>17 Luxembourg</td>
<td>52</td>
<td>160</td>
<td>166</td>
<td>-3.8%</td>
<td>18</td>
</tr>
<tr>
<td>18 Greece</td>
<td>276</td>
<td>161</td>
<td>165</td>
<td>-2.6%</td>
<td>17</td>
</tr>
<tr>
<td>19 Finland</td>
<td>157</td>
<td>163</td>
<td>177</td>
<td>-8.2%</td>
<td>22</td>
</tr>
<tr>
<td>20 Germany</td>
<td>3,044</td>
<td>165</td>
<td>169</td>
<td>-2.7%</td>
<td>19</td>
</tr>
<tr>
<td>21 Cyprus</td>
<td>24</td>
<td>166</td>
<td>170</td>
<td>-2.8%</td>
<td>20</td>
</tr>
<tr>
<td>22 Lithuania</td>
<td>21</td>
<td>170</td>
<td>177</td>
<td>-3.7%</td>
<td>21</td>
</tr>
<tr>
<td>23 Sweden</td>
<td>246</td>
<td>174</td>
<td>181</td>
<td>-4.1%</td>
<td>23</td>
</tr>
<tr>
<td>24 Estonia</td>
<td>24</td>
<td>177</td>
<td>182</td>
<td>-2.9%</td>
<td>24</td>
</tr>
<tr>
<td>25 Latvia</td>
<td>19</td>
<td>181</td>
<td>183</td>
<td>-1.5%</td>
<td>25</td>
</tr>
<tr>
<td>Total/average</td>
<td>13,957</td>
<td>153.5</td>
<td>158.7</td>
<td>-3.3%</td>
<td></td>
</tr>
</tbody>
</table>


5.5.2 Model calculations of the impact of differentiated registration tax according to CO₂ emissions

As mentioned above, a number of factors other than car taxes and car prices need to be considered to explain the different developments in the Nordic countries. To this end, modelling by means of the Danish car choice model has been made using the Danish data to calculate the impact of reforming the registration tax system into a system differentiated according to CO₂ emissions. The aim has been to maintain revenue neutrality.

The present registration tax is replaced by a tax differentiated according to CO₂ emissions of individual car as illustrated in the figure below. The relationship between the present registration tax and CO₂ emissions measured in g/km for the existing car fleet is indicated by blue dots. The figure illustrates that there is a relatively weak relationship between the present registration tax and CO₂ emissions.
A comparative analysis of taxes and CO₂-emissions

The red dots shows the tax differentiated according to CO₂ emissions applied in the model. Diesel cars systematically emit less CO₂ emissions than petrol cars. To keep constant the share of diesel cars, diesel cars are taxed slightly higher than petrol cars in the example. This explains the two lines/sets of dots representing the new registration tax.

The table below presents the results of the model runs. The first line represents the status quo situation, or in other words the average car without changes to the registration tax. The next line shows the results of the model runs in which a registration tax differentiated according to CO₂ emissions is imposed, scenario C.

The table presents the average values of new car sales in Denmark. The average registration tax was DKK 127,020 per new car in 2008 in the baseline situation. A reform of the registration tax structure as in model C would cause the average CO₂ emission to drop from 147g/km to 139g/ km or a 6% reduction. This is reflected by a lower average registration tax and motor vehicle tax than in the present tax system, and consequently slightly lower proceeds accruing to the state (unless the car fleet increases).

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66 Note that the calculated registration tax is exclusive of safety equipment.
5.5.3 Conclusions

In recent years, the Nordic countries have all implemented more or less comprehensive reforms of car-related taxes towards taxes differentiated according to CO$_2$ emissions.

The impact of tax reforms has yet to be seen, however, Finland and Denmark have achieved an 8% reduction in average emissions from new cars from 2007 to 2008 unmatched by any other European countries and probably ascribable, at least to some degree, to tax reforms. Model calculations using a Danish setting indicate that especially reforms of a predominantly value-based registration tax to a tax differentiated according to CO$_2$ emissions would reduce CO$_2$ emissions from the average new car in Denmark to approximately 8 grams of CO$_2$ per km corresponding to a 5.7% reduction.

Tax reforms towards taxes differentiated according to CO$_2$ emissions constitute a CO$_2$ reduction potential.
6. Significance of consumer car choices

In the Nordic countries, the average car is on the road for approximately 18 years once purchased. This highlights the importance of the purchase situation, as it is at this point that the total CO$_2$ emissions from passenger cars are determined. In the coming years, a number of new car types with significantly lower CO$_2$ emissions per km will be launched on the Nordic market. The tax system may be the decisive factor for the willingness to buy such cars.

Data collected for this study indicate that technological leaps may be an important contribution to reducing CO$_2$ emissions from the transport sector. In all countries (excepting Island) CO$_2$ emissions from the average new car have been reduced in recent years, and from 2007 to 2010 the reduction has been significant. Car manufacturers are increasingly offering “ordinary cars” in energy-efficient versions as illustrated in Table 3.1.

The following sections describe a number of interesting cases and developments in the Nordic countries with special focus on developments in the actual and optional choices of consumers in recent years.

6.1 Shift from petrol to diesel cars in the Nordic countries

As a rule, diesel cars emit less CO$_2$ than petrol cars as diesel engines are more energy efficient than petrol cars, but they emit more substances that are harmful to the environment. Petrol cars constituted between 81% and 92% of passenger cars in 2006 to 2007 in the Nordic countries. Today, diesel cars account for a large share of the car sales in the Nordic countries, e.g. 85% in Denmark. In Norway, the diesel share of new cars is also high, whereas the share is substantially lower in Sweden and Finland. This is due to a mix of technical, economic and behavioural changes. Comfortable and low-noise diesel cars are available in the market, and new diesel versions of cars have been introduced at competitive prices. In this way, diesel versions have become attractive to ordinary households in terms of both economy and comfort. The interesting point is that the price difference that brought about the shift is not very drastic, and there is reason to believe that such a shift could be repeated towards other CO$_2$ efficient vehicle technologies.

The new, small energy-efficient petrol cars have become cheaper in Denmark since 2007. This may explain why this segment has grown faster...
than the segment of even more energy-efficient, but slightly more expensive, diesel cars.

Even though sales of diesel cars are soaring, many years will pass before the impact can be fully detected in the passenger car fleet, as illustrated in the figure below, which shows the developments in the diesel share of the car fleet in the EEA countries. Cultural/attitudinal diversity and different economic incentives explain the major differences between the Nordic countries and most other EU Member States. It is noted that, historically, the car fleet in the Nordic countries generally included less diesel cars than in most other EU Member States. The reason for this is partly the relatively high registration tax rendering diesel cars proportionately more expensive. However, another explanation needs to be found in the case in Sweden where historical or behavioural factors probably play a role. Previously, diesel-powered engines were noisier than petrol-powered engines, and this combined with the range of Volvos offered as company cars may also have had an impact on the choice of petrol car vs. diesels.
6.2 Examples of trends in choice of cars in the Nordic countries

The following sections briefly present a number of Nordic examples of choices of energy-efficient or green cars.
6.2.1 CO\textsubscript{2} efficient cars in Finland

The figure below shows the development in the average CO\textsubscript{2} emissions for new and used cars in Finland, where, on the one hand, the tax burden has been moderate, but where annual and registration taxes differentiated according to CO\textsubscript{2} emissions have been imposed since 2007, on the other hand.

The development seems to confirm the significance of introducing tax reforms that reflect CO\textsubscript{2} emissions (hypothesis 5). In a time perspective, however, the effect is also attributable to the simultaneous launch of new energy-efficient diesel cars with a high safety level and a low noise level – which appeal to the broader target group. Basically, Nordic fuel taxes favour diesel cars at the expense of petrol cars, as taxes are lower.

![Figure 6.2 Development in CO\textsubscript{2} efficient cars. Finland, average grams of CO\textsubscript{2} emissions per kilometre.](http://www.stat.fi/tiili_en.html)

6.2.2 Green cars in Stockholm

In Sweden, in August 2010 alone, 43.7\% of consumers bought green cars compared with 38.1\% in the first eight months of the year. This includes alternative-fuelled cars or cars emitting less than 120g CO\textsubscript{2}/km.\textsuperscript{68}

In recent years, Stockholm has actively promoted the sales of green cars. Developments in the number of new car registrations in Greater Stockholm appear from Figure 6.3 below. The share in Stockholm City is even higher. The specific aim of the Stockholm City Council for 2010 was that the share of green cars sold should surpass 35\%, and as can be seen, the aim was achieved. This level was also seen in the rest of Sweden though. In 2009–2010 the special exemption from the city toll ring, has been cancelled and actually a small decrease in the purchase of green cars in the area has been noticed since then. This can also be seen in Figure 6.3 below. The numbers for 2010 is only based on the first three months of the year. Especially the

\textsuperscript{68} Source: Bil Sweden at http://www.mrf.se/pdfer/2010/statistik\%202010-08/Miljöbilsreg_2010-08.pdf
number of cars that uses ethanol as a fuel was less popular. This can partly be due to changed expectations concerning future prices and taxes on the fuel.

![Graph showing the development in green cars in Stockholm.](https://www.stockholm.se/Fristaende-webbplatser/Fackforvaltningssajter/Miljoforvaltningen/Miljobil/Trafikomt/Resultat---Stockholm-i-stort/)

**Figure 6.3 Development in green cars in Stockholm.**

Source: Home page of Stockholm City.

Figure 6.4 illustrates the development in the number of green cars in Stockholm. Numbers for 2010 are only based on the first three months of the year.

![Graph showing the development in green cars in Stockholm in total numbers.](https://www.stockholm.se/Fristaende-webbplatser/Fackforvaltningssajter/Miljoforvaltningen/Miljobil/Trafikomt/Resultat---Stockholm-i-stort/)

**Figure 6.4 Development in green cars in Stockholm in total numbers.**


To support the positive development, Stockholm City has taken several new initiatives, which includes, among other things, collaboration with the ener-
gy company Vattenfall on the installation of charging stations and similar facilities and the introduction of electric cars in 2011. A further aim of the Stockholm City Council is to replace all municipal cars with green cars, and the goal is almost achieved.

Initiatives in Stockholm are primed by government policies and tax policy. Charging stations and an enabling environment are further important when car manufacturers plan to launch new types of car. In the autumn of 2010, Mercedes will launch an electrical version of Smart, in parallel in Sweden and Denmark where cooperation has been initiated with competent partners on the infrastructure side.\(^\text{70}\) The new electric car Saab 9-3 is due for testing in Sweden and will be introduced widely in 2012.\(^\text{71}\)

### 6.2.3 Green cars in Norway

In Norway, a number of green cars will be launched in the next 12 months, including the Mitsubishi i-MiEV. As soon as the sales price became known (see below) 200 cars were bought unseen primarily by private households.\(^\text{72}\) The i-MiEV will soon be followed by similar models, including Peugeot iOn and Citroën C-Zero. According to the car release calendar of Bilnorge (Norwegian car portal) C-Zero will hit the Norwegian market in December 2010.\(^\text{72}\) Nissan Leaf, Peugeot 3008 Diesel Hybrid and Toyota Auris Hybrid are also listed in the Norwegian calendar.

A new Toyota Prius priced at NOK 264,100 with CO\(_2\) emissions of 83g/km will soon be launched in Norway. Preferences for luxury cars can be accommodated by the new Lexus hybrid, which was launched in October 2010. The CT200h is actually a hybrid car (expected CO\(_2\) emission somewhat below 100g/km) offering very “sporty” drivability.\(^\text{73}\)

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\(^\text{70}\) http://www.electronic-supply.dk/article/view.html?id=52086

\(^\text{71}\) http://bilmagasinet.dk/article/48917


\(^\text{73}\) http://www.bilnorge.no/artikkel.php?aid=36291
Table 6.1 Car example.

<table>
<thead>
<tr>
<th>Facts on Mitsubishi i-MiEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Electric</td>
</tr>
<tr>
<td>Effect 47 kW (64 hk) 180 Nm</td>
</tr>
<tr>
<td>Dimensions 347.5x147.5x161 cm (L/B/H)</td>
</tr>
<tr>
<td>Wheel base 255 cm</td>
</tr>
<tr>
<td>Weight 1180 kg</td>
</tr>
<tr>
<td>Accelleration 0-100 km/hour 15 sek</td>
</tr>
<tr>
<td>Maks. speed 130 km/h</td>
</tr>
<tr>
<td>Range appr. 150 km</td>
</tr>
<tr>
<td>CO2 emission 0 g/km</td>
</tr>
<tr>
<td>Price (NOK) 239.900</td>
</tr>
</tbody>
</table>


Cars are gradually being introduced that combine efficiency with a broad consumer appeal – if prices are right, which seems to be the case in Norway.

The figure below shows the development in CO2 emissions per kilometre for new petrol cars (blue), diesel cars (red) and aggregated for new cars (yellow) in the latest 10 years.

![Figure 6.5 Average CO2 emissions from newly registered cars 2001–2009, and up to May 2010.](image)

Note: All cars: Yellow, Gasoline cars: Red, Diesel cars: Blue.
Source: Opplysningsrådet for vegtrafikk.

6.2.4 Increasing number of class A cars in Denmark

Denmark has also seen a growth in the percentage of energy-efficient cars of the total new car sales. According to the Danish Road Safety and Transport Agency, the development is due to “the previous perception among consumers that a class A car is a small city car. Today, however, there are class A
cars that suit almost every purpose – for example five-seat estate cars that can haul a caravan if needed. Such development naturally contributes to the marked growth in the share of class A cars in both the petrol and diesel segments.” The statement refers to the technological development that has fostered more energy-efficient cars that also meet the demands of consumers in terms of performance and other features.

Figure 6.6 Energy classes for diesel cars in Denmark.
Source: Road Safety and Transport Agency, Denmark, 2010, Energy consumption of Danish passenger cars. Fossil fuels and CO2 emissions – how is the relationship?

Figure 6.7 Energy classes for petrol cars, Denmark.
Source: Road Safety and Transport Agency, Denmark, 2010, Energy consumption of Danish passenger cars. Fossil fuels and CO2 emissions – how is the relationship?
It is noted that diesel cars (constituting the majority of the company car segment) have become bigger and heavier, while the opposite is the case for petrol cars. Favourable taxation of heavy diesel cars has intensified developments.

### 6.2.5 Electric cars and hydrogen cars in Iceland

Up to 2007, Iceland saw a very sharp growth in oil consumption in the transport sector. Oil and petrol account for one tenth of Iceland’s total import costs. At the same time, cheap and clean electricity is abundant in Iceland, a fact that has triggered the interest of the Icelandic government and Mitsubishi and other car manufacturers for using Iceland as a test case for electric cars. Moreover, Iceland has established supporting infrastructure and tested hydrogen/fuel cell cars. There is a hydrogen filling station in Reykjavik, and the Mayor of Reykjavik drives a hydrogen car.

From 1995 to 2004, the Icelandic car fleet grew sharply compared with that of the other Nordic countries. According to the Icelandic Roads Administration, road traffic has, however, been declining since 2006, and the drop has continued until 2010, primarily because of the economic crisis. In July 2010, the traffic volume was 3.7% below the level of July 2007.

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74 See appendix 3.
6.2.6 Conclusion

In these years, supply and demand for more energy-efficient passenger cars are changing in the Nordic countries. The keenest interest in and the broadest range of green cars are found in Sweden and Norway, which offer green cars on advantageous terms involving benefits such as low-tax schemes, improved accessibility etc.

Thanks to innovation by car manufacturers and tax reforms towards taxes differentiated according to CO\textsubscript{2} emissions, Nordic governments are now in a position to secure a reduction in CO\textsubscript{2} emissions from passenger cars for the first time in many years.

Experience shows that CO\textsubscript{2} emission reductions may be achieved by tax reforms that heighten the attractiveness of green cars compared to ordinary cars.

To this end, Nordic collaboration on the framework conditions for CO\textsubscript{2} efficient car types may promote a larger market for CO\textsubscript{2} efficient cars in the Nordic countries and increase consumer interest in such cars.
7. Conclusions and findings

Based on the analysis of taxes and CO₂ emissions in the Nordic countries, the key conclusions and findings of the study are summarised below:

7.1.1 Registration tax and annual circulation tax

- The size of the car fleet depends, among other things, on the consumer prices for cars and inherently on the registration tax, if any. The Danish price elasticity of passenger cars is estimated to -0.6\(^7\) and indicates a significant effect of car taxation on the car fleet. This is likely to be the case across the Nordic countries.
- The composition of the car fleet depends on a range of factors besides car taxation. Danish model analysis only foresees minor changes to the average CO₂ efficiency of new cars if the registration tax is abolished. This is because the car fleet will increase and include both more new small and new large cars. Even though the average emission per km does not increase, the growing number of cars results in higher mileage and a rise in the total CO₂ emissions of the transport sector.
- If the registration and circulation taxes are differentiated according to CO₂ emissions, model calculations show that this will influence the composition of the new car fleet towards more CO₂ efficient cars. In recent years, the Nordic countries have all implemented more or less comprehensive reforms of car-related taxes differentiated according to CO₂ emissions, and the development in the CO₂ efficiency of the new car fleet seems to confirm the trend foreseen by model calculations.
- Despite major structural tax differences, ACEA 2008 figures of the overall tax revenue from passenger cars in the Nordic countries (Denmark, Sweden and Finland) per capita display relatively uniform overall revenue. This especially covers higher fuel tax proceeds in Sweden and Finland and higher car tax proceeds in Denmark.

7.1.2 Company car schemes

- Nordic company car schemes for passenger cars include a subsidy element of 10–20 per cent, which has a significant impact on the composition and use of the passenger car fleet.
- Cars purchased as company cars are typically larger than private cars and emit on average more CO₂ per kilometre.

\(^7\) Mogens Fosgerau: Road pricing is not always green, DTU, 2010.
Company cars account for a large share of the car fleet, as 30 to 60 per cent of cars start as company cars in the Nordic countries.

Company cars drive more kilometres per year than private cars as fuel and other operating costs are free or subsidised, with the result that variable driving costs are low or equal zero.

Large potential for change as the company car market is a relatively sensitive market, in which amendments to the legislative framework, including society’s attitudes, may influence company decisions and have a rapid impact on car choices, and thereby on the composition of the car fleet.

7.1.3 Packages of instruments

- Tax packages enhance transparency and may provide a seal of approval/quality stamp of certain car types, which could enhance consumer confidence in cars based on a less known technology.
- Factors such as congestion, safety and parking are important to the consumer and could be integrated elements of packages, giving privileges to green cars.
- Apart from the price signal, an integrated part of packages is the effort to bring about the required behavioural change. Especially for the most energy-efficient cars, a number of psychological/knowledge barriers and lack of confidence cannot be overcome by economic instruments alone.
- In the Nordic countries and especially in the Danish car market, leasing packages have become very popular. It could turn out to be effective to provide state-subsidised leasing of green cars as part of a package of measures.
- Even though the Nordic countries have introduced completely different tax packages, they all follow more or less the same trend towards improving the energy efficiency of new cars sold. So far, Sweden has a higher level of CO\(_2\) emissions per kilometre travelled and a lower diesel share. No assessment has been made of the impact of a Swedish registration tax on a par with Danish or Norwegian registration taxes. This would require a detailed county-specific study.

7.1.4 Increased consumer transparency

- The overall costs of different car types are not fully transparent to consumers. CO\(_2\) emissions may be reduced further by making existing taxation and green transport issues more transparent to consumers, i.e. by informing about costs per kilometre travelled and total costs per year.
- Energy labelling differs across the Nordic countries. In Finland, band A cars must meet more stringent CO\(_2\) norms than in Denmark. Norms in Sweden and Norway range in between Finland and Denmark.
A comparative analysis of taxes and CO₂-emissions

- In Norway and Sweden there are home pages presenting news about green cars, detailed information to consumers about savings in a one, three and five years perspective by choosing the most energy-efficient car, how car owners may organise themselves and share experiences etc. Such initiatives could be adopted by the other Nordic countries

7.1.5 Specific proposals

Based on these findings, a number of possible Nordic initiatives have been identified which could complement and support national initiatives to reduce CO₂ emissions from passenger cars:

- Consolidation and optimisation of existing/proposed CO₂-related reforms in the transport sector in the Nordic countries, possibly using good experiences gained in the other Nordic countries
- Introduction of a common dynamic Nordic green car class, reflecting the gradually improving energy efficiency and CO₂ performance. This will establish a bigger and more transparent Nordic market platform for manufacturers of green cars and at the same time increased transparency and profile of the green car market to the customers
- Nordic cooperation on improved energy labelling of cars, particularly to include the overall annual costs, including fuel costs. Costs may be calculated for 20,000 km travelled annually as used in this study or the variations of 10,000, 20,000 and 30,000 km. Nordic harmonisation of requirements may promote transparency and broader dissemination of information, e.g. on home pages of car manufacturers and car dealers
- Critical review of all Nordic company car schemes for passenger cars to reduce or abolish tax incentives to buy larger cars and drive more. The Nordic Council of Ministers could raise the issue and initiate a specific study on company car schemes. At European level, the company car subsidy issue seems to be even bigger, and Nordic pressure for a joint European initiative could be considered to promote energy-efficient models as company cars

7.1.6 Other instruments

Besides the economic instruments analysed in this study, a number of other economic instruments influence the car fleet and its use, including taxation and allowance for work-related transport in private cars in the public and the private sector and income tax deduction rules for commuting.

These instruments are also essential to the design of the optimal packages as a range of factors influence both purchase and use of passenger cars. To this end, it is imperative to consider a number of instruments (design of schemes and rates of taxes and levies) together and to design packages of
A comparative analysis of taxes and CO2-emissions instruments (taxes and rates of levies) which are consistent, produce the optimum effect and are energy-efficient in terms of environmental objectives.

References

ACEA, the Association of European Automobile Manufacturers. 2010. MOTOR VEHICLE TAXATION: EU Summary, EU tax guide
Center for grøn transport. Trafikstyrelsen, maj 2010. Hvor langt på literen? (How many km is driven on a liter of fuel?)
Danmarks Tekniske Universitet, 2010, Mogens Fosgerau. Roadpricing er ikke altid grøn. (Roadpricing is not always green)
Tetraplan 2008, Bilsafgifter og energiforbrug. Energimæssige effekter af afgiftslempler for personbiler. (Energy effects of changes in taxes for passenger cars)
De nordiske lande har forskellige afgiftsstrukturer for personbiler, hvilket påvirker såvel køb som brug af disse. Der er derfor ved analyse af disse lande et godt udgangspunkt for at analysere bilparken, dens sammensætning og kørselsomfanget – og dermed CO₂-emissionerne fra persontransport.

I TemaNord 2008:587 gives en gennemgang af de forskellige former for beskatning på person- og varebiler i de nordiske lande, hvorfor denne benyttes som udgangspunkt for analysen i denne rapport.

COWI A/S har desuden opdateret og supplered disse data gennem interne og eksterne konsulenter i de nordiske lande for derved at kunne belyse afgiftsstrukturens påvirkning på bilparken og CO₂-emissionen fra denne. Derudover er de nationale statistikker benyttet.

Den gennemsnitlige udledning af CO₂ pr. km fra nye biler er forskellig i de nordiske lande, men fælles for alle landene er, at den gennemsnitlige udledning er faldet kraftigt, især gennem de sidste fire år.

Total gennemsnitlig CO₂-emission fra nyregistrerede biler.

Forskellene mellem de nordiske lande kan ikke kun tilskrives forskelle i bilbeskatningen, men også en række andre faktorer i de enkelte lande og samspillet mellem disse faktorer. Det drejer sig f.eks. om generelle aspekter som indkomstniveau, økonomisk vækst og forventninger hertil, geografiske forhold, befolkningstæthed mv., samt mere specifikke forhold som reguleringer på transportområdet, fradragsregler, firma/bils-ordninger, synlighed og forvent-
ninger til klimapolitikken, udbud af kollektiv transport, traditioner, forbruger-
adfærd mv.

En komparativ analyse af bilbeskatningen og CO₂-udledningen fra person-
biler kan derfor ikke ses isoleret fra de rammer, som biltransporten indgår i i de nordiske lande. I stedet er betydningen af de forskellige skatte- og afgifts-
forhold belyst gennem vurdering af følgende hypotenser:

- Hypotese 1: Registreringsafgiften og årsafgiften kan bidrage til
  reduktion af bilernes CO₂-udslip
- Hypotese 2: Firmabilsortning i Norden giver incitament til store
  biler og megen kørsel pga. subsidiering og fokusering på disse goder
- Hypotese 3: Målrettede pakker af virkemidler kan sikre stort
  gennemslag og er mere effektive end generelle afgiftsstigninger
- Hypotese 4: Synlighed af målsætninger og virkemidler er afgørende
  for, at CO₂-efektive biler får stor udbredelse
- Hypotese 5: CO₂-differentierede afgifter kan bidrage til køb af CO₂-
  effektive biler. Afgiftsomlægningerne af års- og
  registreringsafgifterne i Norge, Danmark og Finland omkring 2007
  har haft betydelig indflydelse på CO₂-udslippet
- Endelig argumenteres for at en målrettet indsats i forhold til bilvalget
  og køb af biler giver det største potentiale for CO₂-reduktion til de
  laveste omkostninger

Vurderingen af hypotenserne er baseret på modelanalyser på COWI’s Bil-
valgsmodel, analyser af statistikker og data samt eksisterende studier og
rapporter. De centrale konklusioner er angivet herunder:

Registratoringsafgift
- Bilparkens størrelse afhænger bl.a. forbrugerprisen på biler, og dermed
  af en evt. registreringsafgift. Baseret på danske forhold vurderes
  priselasticiteten på personbiler at være ca. -0,6. Hvorvidt dette svarer til
  priselasticiteten de øvrige nordiske lande er ikke klart, men der er
  næppe grund til antage speciel stor variation de nordiske lande imellem
- Bilparkens sammensætning: De nordiske data indikerer, at bilernes
  CO₂-effektivitet er større jo højre registreringsafgiften er. Andre forhold
  end afgiften spiller imidlertid ind, og modelanalyser for Danmark
  indikerer blot en mindre stigning i den gennemsnitlige CO₂-effektivitet
  af bilerne hvis registreringsafgiften fjernes. Dette skyldes at der både
  købes en del større biler, og at bilparken samtidig udvides med mange
  små biler, dels i husstande der ikke tidligere havde bil og dels som nr. 2
  biler i husholdninger der allerede har bil. Derimod forventes der at blive
  købt flere biler og følgelig kørt flere kilometre. Det betyder, at sektorens
  samlede CO₂-udslip vil gå op
• Differentiering af registreringsafgiften efter CO₂-emission vil ifølge modellberegninger have effekt på sammensætningen af de nye biler, således at der sker en forbedret CO₂-efektivitet. På danske forhold vurderes en sådan omlægning at forbedre effektiviteten i nye biler med 5,7 %. De nordiske lande har alle gennemført mere eller mindre omfattende omlægninger af bilrelaterede afgifter i retning af CO₂-differentiering i de senere år og udviklingen i CO₂-efektiviteten i bestanden af nye biler synes at bekræfte tendensen i modelresultaterne. CO₂-differentieringen af afgifterne skal dog være betydelig for, at opnå en virkning på bilparkens sammensætning. Der er i dag en højere accept af, at hensynet til energieffektivitet betyder afgiftsforskelle, og bl.a. finanskrisen har gjort, at både privatpersoner og virksomheder har større fokus på omkostninger.

Årsafgift

• Årsafgiftens størrelse, og differentiering heraf, vurderes på baggrund af modellberegnning ligeledes at påvirke bilvalget, i samme retning som registreringsafgiften.

Firmabilskoder

• Subsidie: De nordiske firmabils-ordninger rummer et subsidieelement på 10–20 %, og påvirker i væsentlig omfang sammensætning og brug af personbilparken.
• Større biler: De biler der typisk købes som firmabiler er større end privatbilerne og har gennemsnitlige større CO₂-udledning pr. km.
• Stor del af bilparken: Firmabiler udgør en meget stor del af grundlaget for bilparken, idet 30–60 % af bilerne i de nordiske lande er født som firmabiler.
• Større kørselsforbrug: Der er et helt eller delvist subsidie til driftsomkostningerne, herunder brændstof, til firmabiler, således at de variable kørselsomkostninger er lave eller 0. Dette må formodes at medføre et større kørselsforbrug.
• Stort potentiale for ændring: Firmabils-markedet er et relativt fælles marked, hvor ændringer i regler og rammer, herunder måske også samfundsmæssige holdninger, kan påvirke virksomhedernes beslutninger hurtigt og således sikre et hurtigt gennemslag og ændring af bilkøb, hvilket kan påvirke bilparken væsentlig.
Pakker af tiltag

- Pakkerne af forskellige afgifter, reguleringer mv. giver øget synlighed og kan give en blåstempling/kvalitetsstempling af særlige biltyper, så folk ikke er så nervøse for at købe biler baseret på mindre kendt teknologi
- Elementer som fremkommelighed, sikkerhed og parkering er væsentlige for forbrugeren og kan indgå i pakkerne
- Pakker lægger vægt på at arbejde med adfærdsændring, der er nødvendig, – ud over prissignalet alene. I forhold til de aller mest miljøeffektive biler vil der være en række psykologiske/vidensmæssige barrierer og manglende tryghed, som det vil være for dyrt at overvinde alene ved økonomiske virkemidler
- I Norden og især i Danmark på det danske bilmarked er leasingpakker blevet meget populære. Det kan også overvejes, om staten med fordel kan gå ind og understøtte leasede miljøbiler, som del af en pakke-løsning. Ses på tal fra ACEA 2008 for de samlede skatteindtægter fra personbilstransporten i de nordiske lande (Danmark, Sverige, Finland), er de på trods af de store strukturforskelle i afgifterne relativt ens, når der korrigeres for antal indbyggere. Dette dækker især over højere provenu fra brændstofafgifter i Sverige og Finland og højere provenu fra bilafgifter i Danmark

Øget synlighed hos forbrugerne

- Der er ikke fuld transparens om de samlede omkostninger ved forskellige biltyper hos forbrugerne. Der kan opstå en større CO₂- gevinst med en større synlighed af de eksisterende afgifter og problematikker i forhold til grøn transport, således at forbrugere er bekendt med f.eks. omkostningerne pr. km.
- Der er forskel på energimærkningen i de nordiske lande. I Finland skal der opfyldes noget skrappere CO₂-normer for at være en A-klassebil end det er tilfældet i Danmark. Sverige og Norge ligger ind imellem de to lande
- I Norge og Sverige findes velfungerende hjemmesider med miljøbilsmnyt, som tydeligt fortæller forbrugerne, hvor meget de sparer, ved at vælge den mest energieffektive bil i klassen f.eks. på 1, 3 og 5 år
sigt, hvordan de kan organisere sig og dele erfaringer mv. Dvs. bl.a. tydelig kommunikation af de afgiftsforskelle, som har eksisteret siden 2007. Dette kunne med fordel også etableres i de øvrige nordiske lande

Specifikke forslag

Baseret på disse konklusioner er identifieret et antal konkrete forslag til mulige nordiske initiativer, som kan understøtte de nationale bestræbelser på at reducere CO₂-emissionerne fra personbiler:

- Konsolidere og optimere de allerede foretagne/foreslåede CO₂-relaterede omfængninger i transportsektoren i de nordiske lande, herunder udnytte erfaringer fra de andre nordiske lande
- Indfør en dynamisk nordisk miljøbilsklasse. De økonomiske incitamenter til at købe og køre biler fra denne klasse er allerede i høj grad til stede i de nordiske landes afgiftssystemer i dag, men en øget synlighed og skærpet profil, kan rykke en del nye kunder over i dette købersegment og dermed reducere CO₂-udslippet. Dette vil etabler et større og mere transparent nordisk marked for CO₂-effektive biler både for producenter og forbrugere
- Nordisk samarbejde om løbende forbedringer af energimærkningen af biler, så de samlede økonomiske omkostninger/år fremgår inkl. brændselserheder. Det kan både være ved gennemsnitligt 20.000 km/år, som vi har brugt her eller variationen 10.000, 20.000 og 30.000 køre km/år. En nordisk harmonisering af krav her kan sikre transparens og et bredere gennemslag af oplysningerne, f.eks. i bilforhandlere og producenters hjemmesider og informationsmateriale
- Foretage en kritisk gennemgang af alle de nordiske firmabilserordninger, så det sikres, at alle incitamenter er til at købe relativt store biler og køre relativt meget i den afskaffes. Nordisk Ministerråd kan evt. tage initiativ til at igangsætte en sådan undersøgelse. På europæisk plan synes problemet med firmabilserne at være endnu større, så det kan også overvejes, at de nordiske lande presser på for et europæisk initiativ til at fremme CO₂- og energieffektive biler som firmabilser

Øvrige virkemidler

Udover de økonomiske virkemidler der er analyseret i denne rapport er der også en række øvrige aspekter, der påvirker kørselsomfanget og bilparken, såsom kørselsdeltagelse ved brug af egen bil, i både den offentlige og private sektor, skatteregler for fradrag af udgifter til forretningsrejser og befordringsfradrag for kørsel til og fra arbejde.

Disse virkemidler har ligeledes betydning for de optimale pakker af tiltag, idet flere forskellige forhold påvirker såvel køb som brug af personbiler. Det er derfor nødvendigt at se på en lang række tiltag (udformning af ordninger og satser for skatter og afgifter) under ét, og udforme pakker af tiltag (skatte- og
afgiftssatser) som er konsistente, giver bedst mulig samlet effekt og er om-
kostningseffektive ift. miljømålsætningerne.
Appendix 1

Basic data set and data collection in the Nordic countries

This section collects data from the Nordic countries to establish a basic data set. Data collection takes as its starting point reporting from the previous study: TemaNord 2008:578. In addition, data are supplemented and updated by internal and external sources in the Nordic countries. The purpose of the data set is to obtain an overview of the present situation to enable:

- comparison of central regulatory frameworks for car purchase and usage in the Nordic countries
- mapping of existing economic instruments and their impact
- mapping of potential CO$_2$ emission reductions in the Nordic countries based on national experiences in the Nordic countries

Data were extracted from existing studies (including TemaNord 2008:587) and from national agencies of statistics. In addition, a questionnaire survey was launched in each of the Nordic countries to gather additional information and update selected data, especially concerning important tax changes and to identify new analyses, if any, of the impact of taxes and tax changes.

Passenger car fleet per fuel type

The below table gives an overview of passenger cars per fuel type. Since then, the share of green cars has increased.
Table A1.1. Passenger cars per fuel type

<table>
<thead>
<tr>
<th>Year of statistics</th>
<th>DK</th>
<th>S</th>
<th>N</th>
<th>FIN</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrol (end 2006)</td>
<td>1,758,286</td>
<td>3,804,983</td>
<td>1,688,460</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>*3,607,248</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel (end 2006)</td>
<td>256,444</td>
<td>351,896</td>
<td>386,772</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>*484,093</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric</td>
<td>151</td>
<td>126</td>
<td>1,500</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aug 2010: 3,028</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>12</td>
<td>10,896</td>
<td>176</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>*17,850</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hybrid</td>
<td>0</td>
<td>16,230</td>
<td>55</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>*175,153</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biofuels (mixed)</td>
<td>0</td>
<td>80,934</td>
<td>2,250</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>*175,153</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>2,014,893</td>
<td>4,258,433</td>
<td>2,079,213</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: TemaNord 2008:587 to the extent possible, the number of alternative-fuelled cars has been supplemented by 2010 figures to illustrate developments. Figures derived from questionnaires are marked by an asterisk *, in the cases where figures have been updated. These are not part of the total.

Figure A1.1 Diesel share of newly registered cars.

Source: CDB_AllYears_2010-01-26 Member State Figures, http://www.mrf.se/pdf/eurof2010/statistik%202010-08/Dieselbilsreg_2010-08.pdf and Oplysningsrådet for vejtrafikken A/S (http://www.ofvas.no/BILSALGET/Bilsalget_2010/Fortsatt+h%C3%B8y+registrertstakt+p%C3%A5+nye+personbiler.9UF R/YYk.ips).

The diesel share has grown rapidly in recent years, and the trend continues as illustrated by the following examples. In February 2009, the diesel share accounted for 69.9% in Norway, rising to 74.1% in 2010. According to the Danish home page bilpriser.dk, at 14 July 2010, there has been a dramatic shift in from petrol-fuelled to diesel fuelled company cars, the share of diesel cars now standing at 85% of new Danish company cars.
Car fleet age

Table A1.2 Car fleet age

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>S</th>
<th>N</th>
<th>FIN</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger car fleet, end 2006</td>
<td>9.1</td>
<td>9.1 (*9.6 in 2009)</td>
<td>10.2</td>
<td>10</td>
<td>9.2</td>
</tr>
<tr>
<td>Share of passenger car fleet above 10 years (%)</td>
<td>36</td>
<td>43</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Average fuel consumption and CO$_2$ emissions

Table A1.3 Emission data from road traffic

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>S</th>
<th>N</th>
<th>FIN</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total road traffic CO$_2$ emission, Mt CO$_2$/year</td>
<td>12.2</td>
<td>18.7</td>
<td>10.1</td>
<td>12</td>
<td>0.8</td>
</tr>
<tr>
<td>Year of statistics</td>
<td>2004</td>
<td>2004</td>
<td>2005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emission from passenger car, MtCO$_2$/year</td>
<td>7</td>
<td>13</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average emission from new cars, gCO$_2$/km</td>
<td>Gasoline</td>
<td>164</td>
<td>181</td>
<td>155</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td>Diesel</td>
<td>150</td>
<td>176</td>
<td>159</td>
<td>158</td>
</tr>
</tbody>
</table>

### Taxes in the Nordic countries

#### Table A1.4 Summary of taxes and tax exemptions in the Nordic countries.

<table>
<thead>
<tr>
<th>DK</th>
<th>S</th>
<th>N</th>
<th>FIN</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Registrati-</strong></td>
<td><strong>on tax</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxation fee dependent on fuel consumption (km/l) and particle emissions. Registration fee based on price. Subsidy of DKK 4,000 for mileage of more than 16 km/l (petrol) and 18 km/l (diesel). Additional tax of DKK 1,000 for mileage of less than 16 km/l (petrol) and 18 km/l (diesel). Tax is based on car price: (105% * car price up to DKK 79,000) + (180% * car price above DKK 79,000) + (180% * car price above DKK 79,000). Extra charge and deduction (including deduction for airbag, ABS, radio, 5 star rating in EURO NCAP crash test and seat belt alarms). Electric cars below 2 tonnes are exempt from registration fee.</td>
<td>SEK 0 **</td>
<td>Single tax of 11–67% of car price. of unladen weight + efficiency + CO2. Re-registration tax dependent on weight and age: NOK 1,557–22,248. Hybrid cars emitting less than 120 g CO2/km and electric cars with maximum CO2 emissions of 37 kg per 100 km are exempt from annual car fee for five years following first registration. In the case of electric and hybrid cars used as company cars, the tax base is reduced by approximately 40% compared with similar conventional-fuelled cars.</td>
<td>Tax differentiation according to CO2 emissions. Tax rates vary from 12.2% for cars emitting less than 60 g CO2/km to 48.8% for cars emitting above 360 g/km. The system is linear and technology neutral.</td>
<td>Goods tax of 20/27% of the total car price, 30/45% of trade price for small/large cars above/below 2000 cc.</td>
</tr>
<tr>
<td><strong>Annual tax</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petrol cars: DKK 520–18,460 annually. Diesel cars: DKK 160–25,060 annually. Reduced green taxes/annual taxes for electric cars.</td>
<td>Based on CO2 emissions. Generally, the registration fee is very low. The annual tax for 2005 models and older are based on weight. For 2006 models and younger the annual tax is based on CO2 emissions. Five-year exemption for green cars (incl. petrol cars with low CO2 emissions, electric and hybrid cars).</td>
<td>Petrol: NOK 2,517 kr. Diesel without particle filter: NOK 2,924 kr. Electric cars exempt from annual tax.</td>
<td>Annual tax presently based on weight, from 2011 onwards to be based on CO2 emissions. Taxes will vary from EUR 20 to EUR 605 annually.</td>
<td>ISK 235–2,835 annually depending on weight.</td>
</tr>
<tr>
<td><strong>Other taxes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The state levies a 42.9% tax on the third-party liability insurance premium. The insurance is compulsory. Number plate tax (DKK 1180 in taxes, environmental taxes (DKK 90 annually) and a small tyre tax.</td>
<td>Congestion tax in Stockholm. SEK 10–20 for entering/exiting according to congestion.</td>
<td>Toll ring in Oslo. Passenger cars: NOK 20 for single entering/exiting and NOK 4,100 for annual subscription (source: Fjellinjen AA).</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other tax exemptions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric cars exempt from parking fees in Copenhagen.</td>
<td>Ethanol, gas and electric hybrid cars exempt from congestion tax in Stockholm.</td>
<td>Electric cars exempt from parking fees and tolls in Oslo.</td>
<td>Electric cars exempt from parking fees and tolls in Oslo.</td>
<td>Free parking for electric cars in Reykjavik. In 2008, a project was initiated to offer free charging in the city centre of Reykjavik.</td>
</tr>
</tbody>
</table>

**) The so-called “bilaccisen” (registration tax) was phased out from 1995 to 2000 in Sweden. The registration tax was a modest 3–5% of the sales price.

Company cars

Tax advantages of company car schemes induce employees to choose a larger and less fuel-efficient car than would have been the case in a private purchase. In this way, taxes have a distorting effect, which is to the disadvantage of CO₂ emissions. ⁷⁸

In 2008, company car sales accounted for 30% in Denmark, 44% in Finland, 60% in Sweden ⁷⁹ and 37% in Norway (in October 2010 the share had risen to 40.4% ⁸⁰). Percentages are subject to annual fluctuations.

Table A1.5 Summary of tax regulations for company car schemes in the Nordic countries

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>S</th>
<th>N</th>
<th>FI</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax regulations applying to company cars</td>
<td>Amount added to income: 25% of car value not exceeding DKK 300,000 and 20% of the remaining car value with no upper limit + green tax for cars. (2010)</td>
<td>Tax deduction for green cars. 2010: 9% of car value + 31.7% of basic value + 2.2% of car value as per list prices. Free fuel is taxed at 1.2 times the market price. Mileage above 30,000 km is only taxed at 60% of the price.</td>
<td>2010: tax deduction for green cars. (-50% for electric cars)</td>
<td>Benefit calculated as earned income. The benefit is set at 30% of the car’s list price up to NOK 260,000 and 20% of the car’s list price above that amount over. Tax deductions if the car is more than three years old or if kilometres travelled exceed 40,000 annually.</td>
<td>16.8% of price of new car + EUR 3,240¹¹</td>
</tr>
<tr>
<td>Tax regulations applying to transport allowance for employees using own car for work</td>
<td>Up to 20,000 km: 3.6 DKK/km, above 20,000 km: -1.9 DKK/km, 0.48 DKK/km for bicycles, mopeds and scooters.</td>
<td>Approx. 50%</td>
<td>May 2010: 40.8%.</td>
<td>44%</td>
<td>20% (year 2010)</td>
</tr>
<tr>
<td>Percentage of company cars of new car sales in 2008</td>
<td>30%</td>
<td>60%</td>
<td>64% in 2009 (source: &quot;Fordon 2009&quot;)</td>
<td>Approx. 50% (source questionnaire)</td>
<td>44%</td>
</tr>
<tr>
<td>Diesel share of company cars</td>
<td>Approx. 85% in 2010</td>
<td>Approx. 80% in 2010 ⁸²</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


⁷⁹ Source: same as above.
⁸⁰ http://www.ofvas.no/BILSALGET/Bilsalg_2010/Bilsalget+i+september.9UFrGZH.ips
⁸¹ According to Copenhagen Economics, study on company cars.
⁸² http://www.bilnorge.no/artikkel.php?aid=36153&tid=89
A comparative analysis of taxes and CO₂-emissions

Table A1.7 Passenger transport, million passenger-km.

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>S</th>
<th>N</th>
<th>FI-rounded</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycles/mopeds 30 mph (+walking for SE)</td>
<td>2303</td>
<td>5203</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger cars/vans below 2000 kg</td>
<td>52,454</td>
<td>98,422</td>
<td>57,107</td>
<td>64,300</td>
<td></td>
</tr>
<tr>
<td>Vans above 2000 kg</td>
<td>8,720</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxis</td>
<td>408</td>
<td></td>
<td>636</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor cycles</td>
<td>1,172</td>
<td>1,005</td>
<td>1,260</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>Moped 45 mph</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buses total</td>
<td>7,329</td>
<td>98,758</td>
<td>4,360</td>
<td>7,500</td>
<td></td>
</tr>
<tr>
<td>Train *)</td>
<td>6,474</td>
<td>13,255</td>
<td>3,631</td>
<td>3,900</td>
<td></td>
</tr>
<tr>
<td>Ship</td>
<td>202</td>
<td>835</td>
<td>865</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Aircraft</td>
<td>362</td>
<td>3,234</td>
<td>4521</td>
<td>1,100</td>
<td></td>
</tr>
<tr>
<td>Passenger transport total</td>
<td>79,513</td>
<td>13,0709</td>
<td>72,380</td>
<td>77,800</td>
<td></td>
</tr>
</tbody>
</table>


 *) statistics revised for Finland

Transport allowance when purchasing/owning passenger car

Table A1.8 Overview of system of tax deductions for purchase/ownership of passenger car in the Nordic countries.

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>S</th>
<th>N</th>
<th>FI</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hybrid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration tax</td>
<td>[x]</td>
<td></td>
<td></td>
<td>[x]</td>
<td></td>
</tr>
<tr>
<td>Annual tax</td>
<td>[x]</td>
<td>[x]</td>
<td></td>
<td>[x]</td>
<td></td>
</tr>
<tr>
<td>Electric car</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration tax</td>
<td>[x]</td>
<td>[x]</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Annual tax</td>
<td>[x]</td>
<td>[x]</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company cars, taxation of private individuals</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Source: TemaNord587 and ACEA April 2010

Transport allowance in brief. Below a number of basic transport allowance rates applied by the Nordic countries are provided. In addition, there are a number of supplementary rules, limits, reliefs etc.

Figure A1.2 Overview of transport allowances in the Nordic countries


N: as in DK. Highest tax: 1.32 NOK/km.

S: actual driving costs deductible if daily time saving is more than 2 hours compared to public transport. Up to 18.50 SEK/Swedish mile deductible in 2010.

F: relief 1.64 DKK/km for driving in the absence of public transport.
Taxes on selected cars in the Nordic countries

S: Exempt from annual tax: petrol/diesel/hybrid cars with CO₂ emission figures of up to 120g/km, electric cars with a maximum consumption of 37 kwh/100 km and alternative-fuelled/flexible-fuelled cars with a maximum consumption of 9.2l (petrol), 8.4l (diesel) and 9.7cm/100km (biogas, CNG).

Tolls

Table A1.9 Tolls in European cities

<table>
<thead>
<tr>
<th>By</th>
<th>Within toll area</th>
<th>Region/län</th>
<th>CO₂ reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oslo</td>
<td>3.5% at toll crossing</td>
<td>15%</td>
<td>CO₂ reduction slightly higher than traffic change due to increased speed</td>
</tr>
<tr>
<td>Stockholm</td>
<td></td>
<td>1.30%</td>
<td></td>
</tr>
<tr>
<td>London</td>
<td>21–15%*</td>
<td></td>
<td>CO₂ reduction in the two existing toll areas. Savings of additional 5,000 tCO₂ annually. After October 2008 reform higher Differentiated according to environmental impact</td>
</tr>
</tbody>
</table>

*) In the original “congestion charge” area of 23km² and in the extended area of approximately the same size.

Appendix 2

Assumptions behind the car choice model

*Assumptions for examples in hypothesis 1 on the significance of the registration tax*

The 2002 Car Choice Model was applied, which is based on 1996 to 2001 data, estimated in 2002.

The elasticity of the model has been compared to newer elasticities based on new car purchase data from 2007–2008 used in model calculations by the Transport Department of The Danish Technical University. A comparison of the two model found that the significant elasticities in play in the reduction of the registration tax are at the same level in each model. Even though the Car Choice Model is based on seven to eight year-old data, it is still valid for this purpose.

The model has been updated by car data from 2007 and has been calibrated to ensure that forecasts of diesel share and shares of private cars/company cars correspond to the 2008 figures from Statistics Denmark:

**Table A2.1 Diesel share and company car share of new car sales, Statistics Denmark 2008**

<table>
<thead>
<tr>
<th>Diesel share</th>
<th>Percentage, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private cars</td>
<td>40.3%</td>
</tr>
<tr>
<td>Company cars</td>
<td>57.2%</td>
</tr>
<tr>
<td>Share of company cars</td>
<td>38.4%</td>
</tr>
</tbody>
</table>

Note: the Car Choice Model predicts that 30% of company cars (cars sold for business purposes) follow private cars sales, while the remaining part of company cars is calculated in a separate company car model.

In addition, the model has been calibrated to match fuel consumption figures of 2008 from Statistics Denmark:

**Table A2.2 Fuel consumption, Statistics Denmark 2008**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Fuel</th>
<th>Km/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>Petrol</td>
<td>16.5</td>
</tr>
<tr>
<td>Private</td>
<td>Diesel</td>
<td>20.2</td>
</tr>
<tr>
<td>Business</td>
<td>Petrol</td>
<td>15</td>
</tr>
<tr>
<td>Business</td>
<td>Diesel</td>
<td>19.3</td>
</tr>
</tbody>
</table>

Note: Calibration of fuel consumption is made by adding a contribution to the utility function of the car.
A comparative analysis of taxes and CO$_2$-emissions

The following fuel prices have been applied:

- **Petrol:** DKK 12.37 DKK/l
- **Diesel:** 10.92 DKK/l

Financing offer, Smart

<table>
<thead>
<tr>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrol</td>
<td>DKK 12.37 DKK/l</td>
</tr>
<tr>
<td>Diesel</td>
<td>10.92 DKK/l</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>06.02.2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billto</td>
<td>Konega</td>
</tr>
<tr>
<td>NSR</td>
<td>99.000</td>
</tr>
<tr>
<td>VAT</td>
<td></td>
</tr>
<tr>
<td>Løngeselv</td>
<td></td>
</tr>
<tr>
<td>Contract</td>
<td></td>
</tr>
<tr>
<td>Payment</td>
<td></td>
</tr>
<tr>
<td>Payment</td>
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<tr>
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<td>Phone</td>
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<td>Fax</td>
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<tr>
<td>Sælger,</td>
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<tr>
<td>Bestbestil</td>
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<td>Sælger,</td>
<td></td>
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<td>Bestbestil</td>
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<td>Sælger,</td>
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<td>Bestbestil</td>
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<td>Sælger,</td>
<td></td>
</tr>
<tr>
<td>Bestbestil</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3

Prices of selected car makes in the Nordic countries

Table A3.2 Prices of selected car makes in Denmark and Sweden, EUR, Euro

<table>
<thead>
<tr>
<th>Car type</th>
<th>Specification</th>
<th>Fuel</th>
<th>Total weight, kg</th>
<th>gCO2/ km</th>
<th>km/l</th>
<th>Price incl. tax and VAT DK</th>
<th>Annual circulation tax DK</th>
<th>Price incl. tax and VAT SE</th>
<th>Annual circulation tax SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citroën C1</td>
<td>Citroën C1 1.0i 5X, 3 dørs</td>
<td>Benzin</td>
<td>1200</td>
<td>106</td>
<td>22.2</td>
<td>12.071</td>
<td>70</td>
<td>11.120</td>
<td>Tax free 5 years</td>
</tr>
<tr>
<td>Toyota Aygo</td>
<td>Toyota Aygo 1.0 VVT-i, 5 dørs hatchback</td>
<td>Benzin</td>
<td>1190</td>
<td>106</td>
<td>22.2</td>
<td>11.576</td>
<td>70</td>
<td>10.787</td>
<td>Tax free 5 years</td>
</tr>
<tr>
<td>Toyota IQ</td>
<td>Toyota iQ 1,4D DPF IQ2</td>
<td>Diesel</td>
<td>1285</td>
<td>104</td>
<td>25.0</td>
<td>23.297</td>
<td>177</td>
<td>na</td>
<td>138</td>
</tr>
<tr>
<td>Toyota IQ</td>
<td>Toyota iQ 1,0 VVT-i IQ2</td>
<td>Benzin</td>
<td>1210</td>
<td>105</td>
<td>22.2</td>
<td>21.419</td>
<td>70</td>
<td>na</td>
<td>Tax free 5 years</td>
</tr>
<tr>
<td>Hyundai i10</td>
<td>Hyundai i10</td>
<td>Benzin</td>
<td>1405</td>
<td>119</td>
<td>20.0</td>
<td>12.742</td>
<td>70</td>
<td>10.392</td>
<td>Tax free 5 years</td>
</tr>
<tr>
<td>Toyota Avensis</td>
<td>Toyota Avensis 4 dørs 1.8, 6 gear manual/Valvematic T1/VVT</td>
<td>Benzin</td>
<td>2000</td>
<td>154</td>
<td>15.2</td>
<td>41.084</td>
<td>338</td>
<td>22.157</td>
<td>122</td>
</tr>
<tr>
<td>Toyota Prius</td>
<td>Toyota Prius 5 dørs 1.8 VVT-i E-CVT (aut) (T2)</td>
<td>Hybrid</td>
<td>1805</td>
<td>89</td>
<td>25.6</td>
<td>51.648</td>
<td>70</td>
<td>28.710</td>
<td>Tax free 5 years</td>
</tr>
<tr>
<td>Volvo S40</td>
<td>Volvo S40 DRIVe start/stop 109hk</td>
<td>Diesel</td>
<td>1880</td>
<td>104</td>
<td>25.6</td>
<td>42.253</td>
<td>89</td>
<td>25.787</td>
<td>138</td>
</tr>
<tr>
<td>Ford Focus</td>
<td>Ford Focus 1,6 TDCi DPF (109 hk)</td>
<td>Diesel</td>
<td>1885</td>
<td>115</td>
<td>22.7</td>
<td>37.357</td>
<td>263</td>
<td>21.200</td>
<td>192</td>
</tr>
<tr>
<td>Hyundai ix35</td>
<td>Hyundai ix35 2.0 4wd Premi um 184hk</td>
<td>Diesel</td>
<td>2090</td>
<td>159</td>
<td>16.4</td>
<td>61.031</td>
<td>604</td>
<td>28.596</td>
<td>408</td>
</tr>
<tr>
<td>Lexus RX MPV</td>
<td>Lexus RX MPV</td>
<td>Hybrid</td>
<td>2700</td>
<td>148</td>
<td>15.9</td>
<td>159.899</td>
<td>271</td>
<td>59.615</td>
<td>Tax free 5 years</td>
</tr>
<tr>
<td>Think</td>
<td>Think</td>
<td>Elbil</td>
<td>1397</td>
<td>0</td>
<td>7.5</td>
<td>na</td>
<td>0</td>
<td>na</td>
<td>Tax free 5 years</td>
</tr>
</tbody>
</table>

Sources: national car dealers (Toyota, Citroën, Ford, Lexus, Think and Volvo), Bilsweden.se, DTU, RSK.is, AKE.fi, trafikken.dk, EnergiNord.dk and valutakurser.net.
**Table A3.2** Prices of selected car makes in Norway, Iceland and Finland, EUR

<table>
<thead>
<tr>
<th>Car type</th>
<th>Specification</th>
<th>Fuel</th>
<th>Total weight, kg</th>
<th>gCO2/km</th>
<th>km/l</th>
<th>Price incl. tax and VAT</th>
<th>Annual circulation tax</th>
<th>Price incl. tax and VAT</th>
<th>Annual circulation tax</th>
<th>Price incl. tax and VAT</th>
<th>Annual circulation tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citroën C1</td>
<td>Citroën C1 1.0i 5X, 3 dørs</td>
<td>Benzin</td>
<td>1200</td>
<td>106</td>
<td>22.2</td>
<td>14.588</td>
<td>345</td>
<td>12.648</td>
<td>155</td>
<td>13.341</td>
<td>128</td>
</tr>
<tr>
<td>Toyota Aygo</td>
<td>Toyota Aygo 1.0 VVT-i, 5 dørs</td>
<td>Benzin</td>
<td>1190</td>
<td>106</td>
<td>22.2</td>
<td>15.195</td>
<td>345</td>
<td>16.080</td>
<td>153</td>
<td>11.435</td>
<td>128</td>
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<tr>
<td>Toyota IQ</td>
<td>Toyota IQ 1,4D DPF IQ2</td>
<td>Diesel</td>
<td>1285</td>
<td>104</td>
<td>25.0</td>
<td>24.636</td>
<td>345</td>
<td>20.402</td>
<td>168</td>
<td>na</td>
<td>215</td>
</tr>
<tr>
<td>Toyota IQ</td>
<td>Toyota IQ 1,0 VVT-i IQ2</td>
<td>Benzin</td>
<td>1210</td>
<td>105</td>
<td>22.2</td>
<td>21.418</td>
<td>345</td>
<td>15.508</td>
<td>156</td>
<td>18.540</td>
<td>128</td>
</tr>
<tr>
<td>Hyundai i10</td>
<td>Hyundai i10</td>
<td>Benzin</td>
<td>1405</td>
<td>119</td>
<td>20.0</td>
<td>16.079</td>
<td>345</td>
<td>13.919</td>
<td>187</td>
<td>na</td>
<td>128</td>
</tr>
<tr>
<td>Toyota Avensis</td>
<td>Toyota Avensis 4 dørs 1,8, 6 gear manuel/Valvematic T1/VVT</td>
<td>Benzin</td>
<td>2000</td>
<td>154</td>
<td>15,2</td>
<td>37.653</td>
<td>345</td>
<td>28.601</td>
<td>282</td>
<td>25.862</td>
<td>128</td>
</tr>
<tr>
<td>Toyota Prius</td>
<td>Toyota Prius 5 dørs 1.8 VVT-i E-CVT (au) (T2)</td>
<td>Hybrid</td>
<td>1805</td>
<td>89</td>
<td>25,6</td>
<td>33.730</td>
<td>345</td>
<td>35.529</td>
<td>251</td>
<td>31.622</td>
<td>255</td>
</tr>
<tr>
<td>Volvo S40</td>
<td>Volvo S40 DRIVe start/stop 109hk</td>
<td>Diesel</td>
<td>1880</td>
<td>104</td>
<td>25,6</td>
<td>32.889</td>
<td>345</td>
<td>29.809</td>
<td>263</td>
<td>26.327</td>
<td>255</td>
</tr>
<tr>
<td>Ford Focus</td>
<td>Ford Focus 1,6 TDCI DPF (109 hk)</td>
<td>Diesel</td>
<td>1885</td>
<td>115</td>
<td>22,7</td>
<td>29.733</td>
<td>345</td>
<td>24.088</td>
<td>264</td>
<td>23.516</td>
<td>255</td>
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<tr>
<td>Hyundai ix35</td>
<td>Hyundai ix35 2.0 4wd Premium 184hk</td>
<td>Diesel</td>
<td>2090</td>
<td>159</td>
<td>16,4</td>
<td>60.376</td>
<td>345</td>
<td>35.529</td>
<td>297</td>
<td>40.125</td>
<td>268</td>
</tr>
<tr>
<td>Lexus RX MPV</td>
<td>Lexus RX MPV</td>
<td>Hybrid</td>
<td>2700</td>
<td>148</td>
<td>15,9</td>
<td>109.010</td>
<td>345</td>
<td>86.820</td>
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</tr>
<tr>
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<td>Elbil</td>
<td>1397</td>
<td>0</td>
<td>7,5</td>
<td>30.191</td>
<td>49 na</td>
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<td>0 na</td>
<td>222</td>
</tr>
</tbody>
</table>

Sources: national car dealers (Toyota, Citroën, Hyundai, Ford, Lexus, Think og Volvo), Bilsweden.se, DTU, RSK.is, AKE.fi, trafikken.dk, EnergiNord.dk and valutakurser.net.

1 http://www.bilnorge.no/artikkel2.php?aid=35037&tid=
A comparative analysis of taxes and CO₂ emissions from passenger cars in the Nordic countries

The report discusses how economic instruments can be used to reduce CO₂ emissions from passenger cars in the Nordic countries. The analysis indicate that

- The registration tax and the annual circulation tax can contribute to a reduction in the average CO₂ emission from new cars.
- Company car schemes in the Nordic countries provide incentives for larger cars and increased driving because of subsidies, and this has long term effect as a large share of new cars are registered as company cars but are used as private cars most of their lives.
- CO₂ differentiated taxes can provide incentives to consumers to purchase CO₂ efficient cars.
- Targeted broader packages which besides providing tax incentives also offer advantages to more environmentally friendly cars can be more effective than general tax increases.
- Transparency of targets and instruments is crucial for a large diffusion of CO₂ efficient cars.

The report has been commissioned by the Working Group on Environment and Economics under the Nordic Council of Ministers. The study was carried out by COWI.