



NORWEGIAN MINISTRY OF
THE ENVIRONMENT

Summary in English: Report No. 34 (2006–2007) to the Storting

Norwegian climate policy



Table of Contents

1	The Government's climate policy goals	9	3.7	The Norwegian Commission on Low Emissions	28
1.1	Principles underlying the climate policy goals	9	3.7.1	About the Low Emission Commission	28
1.2	The Government's long-term targets	10	3.7.2	The Low Emission Commission's recommendations	30
1.3	Voluntary strengthening of Kyoto commitments	10			
2	The Norwegian Government's international climate change strategy	12	4	Following up the Government's climate targets and climate action plans	32
2.1	Climate change requires an international response	12	5	Research and monitoring	33
2.2	New and better international climate agreements are needed . . .	12	5.1	Climate research and the development of technology	33
2.3	We must help to limit the growth in emissions in other countries	14	5.1.1	Strengthening climate-related research	33
2.4	We must help developing countries to adapt to climate change	15	5.1.2	Following up the recommendations of the climate research committee .	34
2.5	Cooperation with the UN on carbon neutrality	15	5.1.3	The Research Council's national action plan for climate research . . .	36
2.6	Climate issues and trade	18	5.1.4	Climate research in Norwegian development cooperation	38
			5.2	Climate-related monitoring	38
3	The Government's domestic climate policy	20	6	Sectoral climate action plans	39
3.1	Policy instruments	20	6.1	Sectoral climate action plans	39
3.2	Current cross-sectoral climate policy instruments in Norway	20	6.2	Petroleum and energy	39
3.3	Effectiveness and cost effectiveness	22	6.3	Transport	40
3.4	National target for 2020	24	6.4	Manufacturing industries	42
3.5	Mitigation options for Norway and the associated costs	26	6.5	Primary industries and waste management	42
3.6	Discussion of the costs associated with an ambitious climate policy . . .	27	6.6	Climate-related efforts at municipal level	43

Summary

The world's climate is changing as a result of anthropogenic emissions of greenhouse gases. The global mean temperature has already risen by almost 0.8 °C since the Industrial Revolution, and sea level has risen by 17 cm. The Intergovernmental Panel on Climate Change (IPCC) forecasts a continued rise in temperature and sea level, and an increase in the frequency of extreme weather events. Climate change will have very serious consequences, and poor people in developing countries will suffer the worst impacts. Famine will become more widespread. Children's growth and development will be affected by more serious undernourishment and disease. Mortality from flooding, heat waves, storms and drought will rise. Up to 30 % of plant and animal species in the world are in danger of extinction.

The ultimate objective of the UN Framework Convention on Climate Change is to stabilise greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system. Last year, the Norwegian Government adopted the goal of limiting the average rise in global temperature to no more than 2°C above the pre-industrial level. The IPCC's Fourth Assessment Report estimates that if we are to limit the average rise in temperature to 2.0–2.4 °C, then greenhouse gas emissions must be cut by 50–85 % relative to the 2000 level by 2050. Global emission reductions on this scale will require drastic reductions in greenhouse gas emissions in both developed and developing countries. The Government will ensure that Norway makes a substantial contribution to these reductions.

Greenhouse gas emissions have the same environmental impact regardless of where releases take place. However, the developed countries have a special responsibility for acting to reduce emissions, both because they are responsible for the largest proportion of emissions until now, and because they are in a better economic position to do so. On this basis, Norway should take on a particular responsibility for contributing to global emission reductions. The Government therefore proposes the following targets:

- Norway will be carbon neutral by 2050

- Norway will undertake to reduce global greenhouse gas emissions by the equivalent of 30 % of its own 1990 emissions by 2020
- Norway will strengthen its Kyoto commitment by 10 percentage points, corresponding to nine per cent below the 1990 level.

The Government is pursuing a three-pronged strategy to achieve these targets. The first and most important approach is to work towards a more ambitious international climate agreement. The second is for Norway to contribute to emission reductions in developing countries and in rapidly growing economies such as China and India. The third is to intensify efforts to reduce emissions in Norway.

It is not possible at present to obtain reliable figures for the emission reductions that will be achieved through existing and new measures in the next 10–15 years. Nor do we know which emission reduction measures will be implemented in Norway in the period up to 2020. This will depend among other things on technological advances and trends in carbon prices. Moreover, developments on the Norwegian continental shelf will be particularly important for emission levels in Norway in 2020. In the 2007 national budget, greenhouse gas emissions in 2020 were estimated at about 59 million tonnes CO₂ equivalents. This estimate is based on uncertain figures. Experience shows that the figures in a reference scenario of this kind are often altered as time goes on. On the basis of the mitigation analysis drawn up by the Norwegian Pollution Control Authority, sectoral climate action plans and current policy instruments, the Government considers that a realistic target is to reduce Norwegian emissions by 13–16 million tonnes CO₂ equivalents relative to the reference scenario presented in the National Budget for 2007, when CO₂ uptake by forests is included.

In this case, from about half and up to two-thirds of the cuts in total emissions by 2020 would be made in Norway. The adoption of a new international climate agreement will make it necessary to revise national targets and instruments. If emission trends indicate that Norway will not achieve its targets, the Government will consider further measures.

General policy instruments are a central element of the Government's domestic climate policy. Cross-sectoral economic instruments form the basis for decentralised, cost-effective and well-informed measures to ensure that the polluter pays. When Norway has joined the EU emissions trading scheme, about 70 % of domestic emissions will either be covered by the emissions trading scheme or subject to the CO₂ tax. Certain sources of emissions cannot be incorporated into the emissions trading scheme or made subject to the CO₂ tax. In such cases, the authorities must use other instruments to reduce greenhouse gas emissions. The Government's view is that further regulation should as a general rule be avoided in areas that are already regulated by means of general policy instruments. However, the Government wishes to retain the possibility of using other policy instruments in addition to emissions trading and taxes in these sectors too. For example, the Government will use economic instruments and strengthen the promotion of new technology to make sure that new licences for gas-fired power plants are based on carbon capture and storage (CCS). Further examples of the use of other instruments are the doubling of Government support for new renewable energy developments, proposals for new building regulations and greater promotion of public transport and the railways.

Developing countries and countries with transition economies will account for three-quarters of the growth in CO₂ emissions in the coming years. Aggregate greenhouse gas emissions from these countries are expected to overtake those from today's developed countries by 2030. It is therefore of crucial importance that large-scale emission reduction measures are carried out in these countries.

Global warming as a result of anthropogenic greenhouse gas emissions is the greatest environmental problem facing the world community today. A global response is needed to deal with this problem. The Government will therefore work towards an ambitious international climate agreement that includes as many countries as possible. A concerted international effort to reduce greenhouse gas emissions will over time raise the price of emissions. An anticipated rise in carbon prices will have an immediate influence on investment decisions by the business sector. It is therefore important to establish the credibility of broad-based international efforts to reduce greenhouse gas emissions. Political decisions too must be based on the assumption that carbon prices will rise.

In addition to being more cost-effective, climate-related measures in developing countries can have a substantial positive development effect, since such projects contribute to sustainable development in the host country through capital transfers.

This English summary of the white paper presents the Government's climate policy targets and three-track strategy to achieve these targets, its plans for research and monitoring programmes, and proposed climate action plans and sectoral targets for the main sectors responsible for greenhouse gas emissions in Norway. Action plans have been drawn up for the following sectors: petroleum and energy, transport, the manufacturing industries, primary industries and waste management, the municipalities, and functions in the state sector. The main purpose of the action plans is to identify measures that will result in cost-effective emission reductions that are not currently being implemented in the sector concerned. This is also the starting point for the targets set out for each sector. The sectoral targets are based on estimates, and will have to be reviewed in response to any changes in projections, costs, technological advances and other relevant factors.

For each sector, the currently estimated technical emission reduction potential is presented, together with measures the Government proposes to initiate.

The Ministry of the Environment commissioned the Norwegian Pollution Control Authority to analyse mitigation options for period up to 2020. The analysis mainly considers technical mitigation measures. It does not to any great extent include options involving major social change, changes in production levels or changes in behaviour. The Government will in particular consider measures that will be cost effective with a projected rise in carbon prices over the lifetime of the investments, and that will not necessarily be implemented in response to current policy instruments. In this connection, priority will be given to measures that promote technological developments. Measures may also be considered to encourage the population as a whole to begin a changeover to a low-emission consumption pattern sooner than they would as a result of the projected rise in carbon prices alone.

The Government intends to make five-yearly reviews of progress and how the use of policy instruments at national level should be further developed. As part of the review process, the Government will commission independent expert analyses of Norwegian climate policy from institutions and/or people with wide experience and knowl-

edge of the development and implementation of climate policy. The Government also proposes that an evaluation of climate policy and how policy instru-

ments should be modified should be submitted to the Storting midway through the first Kyoto period (in 2010).

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1 The Government's climate policy goals

1.1 Principles underlying the climate policy goals

Norwegian climate policy is based on internationally recognised and well-established principles and criteria. Effectiveness and cost-effectiveness are two key criteria for policy instruments, and are further discussed in Chapter 3.3. The polluter-pays principle is another important element of climate policy. This states that the polluter should bear the costs of environmental damage. The concept of tolerance limits and the precautionary principle are closely linked to the principle of sustainable development, which underlies all areas of the Government's policy, and they can be regarded as means of putting sustainable development into practice.

To ensure that the tolerance limits of the environment are respected, targets must be set in accordance with the carrying capacity of the environment and its capacity to absorb pollution without damage. This approach underlies the ultimate objective of the Convention on Climate Change, which is to stabilise greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system. Thus, the situation of the whole ecosystem must be evaluated, and not only that of isolated elements. The precautionary principle states that where there is a threat of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. In other words, «where there is scientific uncertainty, nature should be given the benefit of the doubt», as the principle was explained in the

2007 national budget. Climate change is in practice irreversible. It is already causing serious damage, and the impacts are expected to worsen considerably unless steps are taken to cut emissions sufficiently. Even though we lack full scientific certainty about causes and future trends, the level of ambition in global climate policy should be based on likely scenarios, with a particular emphasis on potentially dramatic outcomes.

Climate policy has substantial distributional effects. The impacts of climate change vary greatly between countries and population groups, and climate policy should therefore include a strong element of equitable distribution and international solidarity. The fact that the rich countries of the world are largely responsible for the rising concentrations of greenhouse gases in the atmosphere makes this even more important. There is an equally clear need for solidarity and equitable distribution between generations. The scale of greenhouse gas emissions and the rate at which they are rising constitute one of the clearest breaches of the principle of sustainable development today.

The EU has set clear climate policy targets for 2020. The Government will work closely with the EU on climate policy issues. Many of the climate policy measures that are to be implemented at sectoral level will come within the scope of the EEA Agreement, and in many cases they will be drawn up through the EU/EEA structures for preparing new legislation. The Government will therefore regularly evaluate the opportunities offered by new proposals for policy and legislative instruments within the framework of the EEA.

1.2 The Government's long-term targets

On this basis, the Government will design Norway's climate policy to achieve the following long-term targets:

- Norway will undertake to reduce global greenhouse gas emissions by the equivalent of 30 % of its own 1990 emissions by 2020
- Norway will be carbon neutral by 2050.

Moreover, Norway will serve as a driving force in the efforts to develop a new, more ambitious and comprehensive international agreement on climate change after the first Kyoto commitment period, using as a starting point the aim of limiting the average rise in global temperature to no more than 2°C above the pre-industrial level.

The target of achieving carbon neutrality by 2050 means that Norway will take responsibility for reducing global greenhouse gas emissions by the equivalent of 100 % of its own emissions by 2050. In this way, emissions from Norwegian territory will be neutralised by emission reductions Norway pays for in other countries, through emissions trading or other mechanisms that become available. This target says nothing about the level of Norwegian emissions in 2050, only that they are to be neutralised regardless of the volume of emissions. However, current knowledge indicates that if global emissions are to follow a path consistent with the long-term objective of stabilising the global temperature, major changes will be required in emission and consumption patterns in the developed countries, including Norway. In the long term, Norway must become a low-emission society.

The Government's reduction target for 2020 includes both emission reductions in Norway, including CO₂ uptake by forest, and Norway's contribution to emission reductions in other countries. Possible emission reductions in Norway are discussed in Chapter 3.5. If the Kyoto Protocol's rules for the land use, land-use change, and forestry (LULUCF) sector are maintained, a net CO₂ uptake by forests of up to about three million tonnes should be eligible for inclusion in Norway's greenhouse gas inventory for 2020. It is not possible at present to obtain reliable figures for the emission reductions that will be achieved through existing and new measures in the next 10–15 years. Nor do we know which emission reduction measures will be implemented in Norway in the period up to 2020. This will depend among other things on technological advances and trends in carbon

prices. Moreover, developments on the Norwegian continental shelf will be particularly important for emission levels in Norway in 2020.

In the 2007 national budget, greenhouse gas emissions in 2020 were estimated at about 59 million tonnes CO₂ equivalents. This estimated is based on uncertain figures. Experience shows that the figures in a reference scenario of this kind are often altered as time goes on.

On the basis of the mitigation analysis drawn up by the Norwegian Pollution Control Authority, sectoral climate action plans and current policy instruments, the Government considers that a realistic target is to reduce Norwegian emissions by 13–16 million tonnes CO₂ equivalents relative to the reference scenario presented in the National Budget for 2007, when CO₂ uptake by forests is included. In this case from about half and up to two-thirds of the cuts in total emissions by 2020 would be made in Norway.

The adoption of a new international climate agreement will presumably make it necessary to revise national targets and instruments. If emission trends indicate that Norway will not achieve its targets, the Government will consider further measures.

The problems associated with climate change are of such a serious and long-term nature that broad political consensus should be sought on Norway's targets.

When considering emission reductions outside Norway that are to be funded by the Norwegian Government, the Government will concentrate on measures and projects that will ensure that climate policy has the greatest possible positive effect on economic development and poverty reduction in developing countries.

1.3 Voluntary strengthening of Kyoto commitments

During the first commitment period under the Kyoto Protocol (2008–2012), the Government will

- strengthen Norway's Kyoto commitment by 10 percentage points, corresponding to nine per cent below the 1990 level
- ensure that a substantial proportion of Norway's emissions reductions are achieved through domestic action.

The gravity of the situation makes rapid cuts in emissions necessary. The Government therefore wishes Norway to undertake to reduce its greenhouse gas emissions by 10 percentage points more

than its Kyoto commitment. This extra commitment will to a large extent be met by funding emission reductions in developing countries. In this way, substantial reductions can be realised at relatively low cost, and Norway will at the same time contribute to development and poverty reduction in the countries where such measures are carried out. This initiative also contains an appeal to other developed countries to voluntarily strengthen their Kyoto commitments. Such initiatives will counteract the risk that the volume of assigned amounts under the Kyoto Protocol is greater than countries need, so that the Protocol does not in practice result in cuts in emissions. Under the Kyoto Protocol, Norway has an international obligation to ensure that its average annual greenhouse gas emissions in the period 2008–2012 are not more than one per cent higher than in 1990. The Kyoto

Protocol provides for parties to use the Kyoto mechanisms as a supplement to national measures in fulfilling their emission commitments. The Kyoto mechanisms are emissions trading, Joint Implementation and the Clean Development Mechanism.

The Government's target means that Norway's emissions average emissions for the period 2008–2012, when use of the Kyoto mechanisms is taken into account, are to be nine per cent lower than they were in 1990. The Government intends to take a broad-based approach in order to achieve Norway's Kyoto commitment. This will involve a combination of national measures and use of the Kyoto mechanisms as envisaged by the Protocol, and a substantial proportion of Norway's emission reductions are to be achieved through domestic action.

2 The Norwegian Government's international climate change strategy

2.1 Climate change requires an international response

Global warming as a result of anthropogenic greenhouse gas emissions is the greatest problem facing the world community today. An international response is needed to deal with this problem. The Government will therefore work towards an ambitious international climate agreement that includes as many countries as possible. A concerted international effort to reduce greenhouse gas emissions will over time raise the price of emissions. An anticipated rise in carbon prices will have an immediate influence on investment decisions by the business sector. It is therefore important to establish the credibility of broad-based international efforts to reduce greenhouse gas emissions. Political decisions too must be based on the assumption that carbon prices will rise.

2.2 New and better international climate agreements are needed

Norway has been playing an active role in efforts to achieve effective international agreements since climate change was first placed on the international political agenda. The Government intends to continue this active role in the years ahead.

Norway views the UN Framework Convention on Climate Change (UNFCCC) as the key framework for international cooperation on climate change. This is the basis for the Kyoto Protocol, and should also be the basis for any global climate agreement in the future. The Government considers it important to use a long-term target as a basis for future emission commitments, and has therefore set the target that the average rise in global temperature should be limited to no more than 2°C above the pre-industrial level. Achieving this target will require a high level of participation in a future climate change regime. Current emission commitments under the Kyoto Protocol apply to only about 30 % of global greenhouse gas emissions, which is by no means sufficient as a response to

the problem of climate change. In the Government's view, it is therefore essential that we succeed in establishing a broader-based, more ambitious and binding global climate change regime. The developed countries must take the lead in accepting responsibility for emissions cuts, but in the long term all countries that generate large volumes of emissions will have to play their part if we are to achieve the necessary global reductions in emissions.

The long-term goal should be to establish a global price for greenhouse gas emissions, and one way of achieving this is to develop a more global emission trading system. An international system would also make it possible for other countries than Norway to become climate neutral by 2050. The countries that have emission commitments under the Kyoto Protocol have agreed to emission limitations totalling about 11 billion tonnes per year in the period 2008–12. An overall limitation of the volume of emissions, combined with a duty to surrender emission allowances, forms the core of an emission trading scheme. The initial distribution of emission allowances between the countries taking part in an emission trading scheme does not influence the overall effect of the scheme. It is the total number of allowances that is important. However, the distribution of allowances acts as a powerful mechanism for income distribution between countries. Allowances should be allocated on the basis of the principle of common but differentiated responsibilities. In accordance with the same principle, the requirement to surrender allowances corresponding to a country's own emissions should apply to all parties to the scheme.

The Government has decided that Norway will undertake to reduce global greenhouse gas emissions by the equivalent of 100 % of its own emissions by 2050. If other developed countries follow this example, it will serve to cover part or all of the costs incurred by countries where per capita income is lower if they accept emission commitments under a new agreement.

The total allocation of assigned amounts under the Kyoto Protocol is too generous. An interna-

tional climate change regime should establish a carbon price that is sufficiently high to ensure that the climate automatically becomes a factor in day-to-day decisions made by firms, individuals and the public sector. If all countries that have commitments under the Kyoto Protocol follow Norway's example and voluntarily strengthen these commitments by 10 percentage points, this will result in a rise in the price of allowances during the first commitment period.

Status of negotiations under the Climate Change Convention

The UNFCCC lays down the principle that the developed countries should take the lead in efforts to combat climate change and its adverse effects. World production and consumption patterns must be changed, and the developed countries have a special responsibility for leading the way. However, both per capita and total emissions are expected to rise substantially in developing countries. Most of the anticipated rise in greenhouse gas emissions will be in non-OECD countries. In the longer term, important developing countries will also have to take on emission commitments if we are to achieve the long-term goals of the UNFCCC.

Several forward-looking processes are under way within the framework of the UNFCCC and the Kyoto Protocol, including negotiations on new emission commitments for developed countries under the Protocol for the period after 2012. The Protocol sets out emission commitments for the period 2008–12 for developed country parties. The US and Australia have not ratified the Protocol. In accordance with the provisions of the Protocol, negotiations on commitments for subsequent periods were started at the first meeting of the parties in Montreal in December 2005. In the first instance, these negotiations only apply to countries that have taken on commitments for the first period. However, other countries can also take on commitments for the second period in the course of these negotiations. Such commitments become binding through ratification, which is required for all changes. So far, there is nothing to suggest that any new countries are intending to take on commitments through these negotiations.

The Conference of the Parties to the Convention in Montreal in December 2005 agreed to engage in a dialogue to exchange experiences and analyse strategic approaches for long-term cooperative action to address climate change. Because the dialogue has been established under the Con-

vention, it is open to all parties. It is to involve four workshops over a two-year period, and a final report will be presented to the Conference of the Parties in Bali in December 2007. The decision to establish the dialogue makes it clear that it will not open any negotiations leading to new commitments. However, it should be possible to use the final report on the dialogue as a basis for further work on the development of a new climate change regime.

The international negotiations on long-term reductions in greenhouse gas emissions have been strongly influenced by the unwillingness of the current US Administration to take part. So far, it has not been possible to draw the large developing countries into the negotiations either. It is particularly difficult to persuade these countries to take part in the negotiations on future emission commitments as long as the US is not involved. The most important task today is therefore to convince the necessary parties to come to the negotiating table. The Government is using a number of channels to contribute to this, including bilateral contacts and cooperation and multilateral forums. The signals from the G8 + 5 meeting at the Heiligendamm summit in June 2007 were that the US and leading developing countries are responding positively to the idea of negotiations on a future climate change regime under the UNFCCC, which may make it easier to get the negotiations under way.

In Norway's view, the Kyoto Protocol provides a good basis for continued cooperation. It will be particularly important to retain key elements of the Protocol, such as differentiated emission commitments, to include all greenhouse gases, and to continue the use of flexibility mechanisms such as emissions trading and project activities. Another important point is that it should be possible to use the institutional framework that has already been established as a basis for future international cooperation. Norway is willing to consider various models that will open the way for more binding participation by developing countries and at the same time ensure cuts in emissions, while also incorporating the necessary flexibility and positive incentives. In the long term, however, we should be aiming for a global price for greenhouse gases. One way of achieving this is to develop a more global emission trading system. This means that in the long term, all countries should take on emission commitments. At the same time, the developed countries should be prepared to assist developing countries in limiting emissions, developing technology and adapting to climate change.

2.3 We must help to limit the growth in emissions in other countries

The Government has decided that Norway is to meet its Kyoto commitment by means of a combination of national measures and use of the Kyoto mechanisms as envisaged by the Protocol, and that a substantial proportion of Norway's emissions reductions are to be achieved through domestic action.

In the 2007 national budget, the budget of the Ministry of Finance includes an allocation for the purchase of units through the Kyoto mechanisms JI and CDM.

The Government intends Norway to contribute to emission reductions in other countries by purchasing emission reduction units from projects under the Clean Development Mechanism (CDM) and Joint Implementation (JI). The rulebook that has been developed for the Protocol ensures that projects implemented in other countries bring important benefits in addition to their climate-related effects. Measures to reduce greenhouse gas emissions internationally, particularly through the Kyoto mechanisms, can result in transfers of technology and contribute to sustainable development. This is particularly true of emission reductions financed through the CDM, since project activities are required to assist developing countries in achieving sustainable development. Transfers of technology and promotion of sustainable development are both important in efforts to deal with the problem of climate change. In these ways, rich countries can help the poorer parts of the world to avoid the polluting path of development they themselves have followed.

Purchases of project-based units under the Kyoto Protocol should promote high environmental standards, and the Norwegian state will therefore only purchase emission reductions that are certified by the UN. Under UN rules, only projects that would not otherwise have taken place may be approved. Furthermore, the Government wishes international guidelines to be respected when project-based units are purchased from hydroelectric power production project activities with a generating capacity exceeding 20 MW. The Government will when purchasing project-based units under the Kyoto Protocol seek to use market mechanisms to obtain the best possible price for a given level of risk.

Development funding can also be used to reduce greenhouse gas emissions. The guidelines for use of Official Development Assistance (ODA) do not permit direct purchases of emission credits.

However, provided that certain conditions are fulfilled it is possible to invest this type of funding in emission-reduction projects under the CDM (see box 2.1). In addition to bringing about cost-effective emission reductions, such projects involve transfers of knowledge, technology and funding that can promote sustainable development. Thus, CDM projects have the potential to be good development tools as well.

The Government will provide development assistance funding for CDM project activities. The poorest countries have made it clear that they are interested in attracting such investments, and development funding may be necessary as to get projects under way, for example through capacity building. This must be done without diverting ODA away from the poorest countries. Projects that receive funding must be in accordance with Norway's development policy as regards the Millennium Development Goals, poverty orientation and recipient responsibility.

Norway will also make a contribution to limiting emissions through the development of climate-friendly technology and the transfer of such technology and related expertise to developing countries. This is much in demand by the developing countries, partly because technology transfers are closely linked to economic growth. In addition, environmental technology is indispensable in efforts to reduce greenhouse gas emissions and other adverse effects on the environment. This type of support is also a crucial means of making it possible for developing countries to follow a less polluting and energy-intensive path of development than the developed countries have done. Cooperation on the development and transfer of climate-friendly technology is therefore an important means of encouraging developing countries to join a future climate change regime. The Kyoto mechanisms are important channels for such transfers.

In the context of climate change, the development and transfer of technology in the fields of energy efficiency and renewable energy sources are particularly important. In many of the large developing countries, energy use is to a large extent based on coal. The world as a whole will continue to be dependent on fossil fuels for many years. The International Energy Agency (IEA) has estimated that world demand for energy will rise by more than 50 % up to 2030, and that more than 80 % of the necessary energy production will be based on fossil fuels. This highlights the need to develop alternative energy sources for large parts of the world.

Given the projections of future energy demand, the Government expects that carbon capture and storage will be a key tool in reducing the world's aggregate greenhouse gas emissions. The Government wishes to use Norwegian expertise in this field to contribute to reductions in CO₂ emissions through international technology transfers. Approval of carbon capture and storage technologies for use under the CDM will be an important means of encouraging their use in developing countries.

2.4 We must help developing countries to adapt to climate change

The people of poor countries are more dependent on natural resources and agriculture for their livelihoods than people in the rest of the world. This also makes these countries more vulnerable to climate change. Their vulnerability is not due to natural conditions alone; it is often intensified by widespread poverty, rapid population growth, poor governance and weak institutions.

Both Norway and the EU aim to limit the average rise in global temperature to no more than 2°C above the pre-industrial level. However, even if this target is achieved, poor regions of the world will be hard hit by climate change. Adaptation is therefore of key importance for these areas. This includes everything from economic diversification to knowledge and technology development, capacity building and social planning.

Climate change is already hampering economic development in most developing countries. For example, the droughts in 1997–98 and 1999–2000 cost Kenya more than 40 % of its GDP. Unless developing countries can substantially reduce their vulnerability to climate change, they will not be able to achieve positive long-term development trends. It is therefore of crucial importance to make the national economy in vulnerable countries independent of climate change and variability, particularly as regards rainfall. Thus, the key to adaptation to climate change is development and economic growth. Adaptation measures must be an integral part of development cooperation efforts to reduce vulnerability. Measures and strategies must be adapted to local conditions – there is no one model that fits all.

The Government has commissioned an analysis of the impacts of and vulnerability to climate change in eastern and southern Africa. This will provide a good basis for Norwegian action in cooperation with national authorities. Norway is

already engaged in extensive development cooperation in these areas, so that it is possible to make a real difference. Support for adaptation efforts will be provided both as direct support to individual countries and via multilateral channels such as UNDP.

The need for development and the need for adaptation to climate change are strongly linked, and this is reflected in the Norwegian action plan for environment in development cooperation, in which climate change is one of the thematic priority areas. Adaptation measures and sustainable development in developing countries will also be essential in order to achieve the necessary global cuts in emissions. In this context, development assistance and technology transfers that will enable people in the poor countries of the world the opportunity to follow a less polluting and energy-intensive path of development than the developed countries are of crucial importance. Support for adaptation measures in the most vulnerable countries, for example African countries and small island states, is also a priority area of Norwegian development cooperation. In more general terms, such support also improves the capacity of these countries to take part in a future regime for reducing emissions after the end of the Kyoto commitment period in 2012, and makes it more attractive for them to do so.

2.5 Cooperation with the UN on carbon neutrality

The UN Secretary-General has announced plans to make UN agencies carbon neutral. This is part of the «Greening the UN» initiative to increase environmental awareness in the UN and reduce the environmental impact of UN operations. UNEP has been appointed to lead this effort. The UN has approached Norway, as one of the first countries to set a clear target date for achieving carbon neutrality, and has proposed cooperation with the Norwegian Government on achieving carbon neutrality within the UN system. The UN Secretary-General is taking steps to put environment and climate change high up on the international agenda. He has announced a high-level event on climate change to be held in connection with the UN General Assembly in September 2007, and has appointed three special envoys on climate change, including former Norwegian Prime Minister Gro Harlem Brundtland. These initiatives will be important in mobilising international support for a new climate change regime. The latest carbon neu-

Box 2.1 The Clean Development Mechanism

The Kyoto Protocol provides for flexibility in how emission commitments are achieved through its three flexibility mechanisms: Joint Implementation, emissions trading and the Clean Development Mechanism (CDM). These make it possible for countries to acquire emission units through participation in project activities or emissions trading, and use them towards meeting their emission targets under the Kyoto Protocol. The Kyoto mechanisms make it possible to achieve cost-effective reductions of global greenhouse gas emissions. Each unit that is transferred using these mechanisms represents one tonne of emissions expressed in CO₂ equivalents. According to the Protocol, use of the Kyoto mechanisms is intended to be a supplement to domestic action to reduce emissions.

The CDM can make a substantial contribution towards a more sustainable and less carbon-intensive path of development. It has two purposes:

1. to assist developing countries in achieving sustainable development
2. to assist developed countries in achieving compliance with their emission limitation and reduction commitments in a cost-effective way.

The transfers of funding and technology that take place when project activities are implemented are intended to play a part in limiting emissions and helping host countries to achieve sustainable development. In addition, developed countries are assisted to achieve compliance with their commitments in a cost-effective way. Reductions in emissions resulting from a project must be additional to any that would occur in the absence of the CDM-related part of the project (the additionality requirement).

A strict rulebook has been developed for the CDM to ensure that the number of certified emission reductions (CERs) issued does not exceed the emission reductions that have taken place. Third-party verification of emission reductions is required.

The implementation of projects is monitored systematically through collection and archiving of relevant data. The data collected are used to verify the emission reductions achieved by a project. CDM projects must be approved by the CDM Executive Board before CERs can be issued.

The additionality requirement is a key criterion for projects under the CDM. This means that developers must substantiate how their projects will result in reductions in greenhouse gas emissions that are additional to those that would occur in the absence of the projects.

There is considerable uncertainty as regards projected emission trends in the absence of CDM projects. This problem is addressed by limiting the crediting period for each project, so that CERs are only issued either for a fixed period of ten years or for a maximum of three times seven years, with a new assessment at the end of each seven-year period.

The owner of the CERs generated by a CDM project is normally specified in the contract between the investor and the project host. There is a wide degree of freedom in the wording of such contracts. It is most usual for the CERs generated by a project to be owned by the investor. However, they may also be owned by the project host, who can then sell them in the emissions trading market. Similarly, it is possible to enter into contracts to purchase CERs from a CDM project without investing directly in the project.

After a slow start, the CDM market is now growing rapidly. So far, Asia and Latin America have attracted the bulk of CDM investments, and only a few projects are under way in Africa. Factors that tend to discourage foreign investment in developing countries generally, such as poor governance, also have an effect in the context of the CDM. In addition, there is a limit to the cuts in emissions that can be achieved in small, poor countries. A CDM capacity building initiative for the poorest countries has been established by the UN Development Programme (UNDP) and the UN Environment Programme (UNEP) (the Nairobi Framework). The aim is to give these countries a better basis for attracting CDM investments.

In 2004, the OECD Development Assistance Committee (DAC) decided that ODA funding may be invested in CDM project activities provided that the value of the CERs generated by a project is deducted from reported ODA as the CERs are issued, which is similar to the system used for concessional loans. Alternatively, the contract can lay down that the CERs generated become the property of the project host. In this case, they can be sold on the emissions trading market. Funds used to purchase CERs directly may not be reported as ODA. It is also a condition that any use of ODA funding for CDM projects must not divert ODA away from the poorest countries. In other words, ODA funds may be used to establish CDM projects that will promote development, provided that the funding is not used for direct purchases of emission credits in order to meet the donor country's national emission commitments.

Box 2.2 Greenhouse gas emissions in China, India and Indonesia*China*

According to the International Energy Agency (IEA), China will overtake the US as the world's biggest emitter of CO₂ before 2010 (about 6 gigatonnes CO₂ equivalents in 2009). If no policy changes are made, China's emissions are projected to rise to about 10 gigatonnes in 2030, as compared with about 7 gigatonnes for the US. The most important explanation for China's high CO₂ emissions is its use of coal as an energy source. China currently meets about two-thirds of its energy needs from domestic coal production. The country has large coal reserves, and coal will therefore continue to be the dominant energy carrier for the foreseeable future. In addition, oil and gas consumption is rising rapidly, and energy efficiency is low. However, it should be noted that per capita levels of CO₂ emissions and energy use in China are low. The US Department of Energy has calculated that China's per capita emissions of CO₂ from consumption and flaring of fossil fuels were 3.62 tonnes in 2004. The equivalent figures for the US and Norway were 20.18 tonnes and 11.18 tonnes respectively, and the average for the world as a whole was 4.24 tonnes.

China is a party to the UNFCCC and the Kyoto Protocol, but as a developing country party has no quantified emission commitment under the Protocol.

Norway began environmental cooperation with China based on ODA funding in 1995. For the first few years, the emphasis was on knowledge building, but projects are now focusing on capacity building to address and resolve environmental problems. Because China has a key role to play in dealing with global climate change, the Government intends to expand cooperation relating to climate, environment and energy. China is the country that has made most use of the CDM.

India

India is a party to the UNFCCC and the Kyoto Protocol, but is not required to submit regular greenhouse gas emission inventories. According to estimates from sources including the World Resources Institute, India is the fourth largest emitter in the world, after the US, China and Russia. According to figures from the US Carbon

Dioxide Information Analysis Center, India's emissions have risen by about 88 % since 1990. The country's emissions are expected to double by 2030 compared with the 1990 level, and will then be equivalent to about 9 % of total global emissions. However, per capita greenhouse gas emissions are low, at about 1.3 tonnes, and projections indicate that they will still be considerably lower than in the developed countries in 2030. Coal-fired power plants are India's most important energy source, and account for a large proportion of the country's emissions. India is believed to have the world's third largest reserves of fossil fuels. Annual economic growth is running at about 8 %, and energy demand is therefore high. In order to reduce its emissions, India will have to address the question of how its growing energy demand can be met with less impact on the climate.

India plays an important role in the international CDM market. Most of the projects approved by the Indian authorities concern energy efficiency, biomass and renewable energy sources. India is the country that has registered the largest number of projects with the CDM Executive Board, but most of them are on a fairly small scale.

Cooperation between Norway and India on climate issues involving ODA funding is currently limited in scope, and includes small-scale research projects on climate-related changes in agriculture and measurements of air pollution. The Government has recently taken the initiative for a broader strategic partnership between Norway and India on climate change issues. In addition to CDM project activities, possible areas of cooperation include research on ice-melt in the Himalayas, renewable energy, carbon capture and storage, and a policy dialogue.

Indonesia

Indonesia ranks 16th among the world's largest emitters of CO₂, but fourth when emissions from deforestation and land-use change are included. Per capita emissions of greenhouse gases are about 4.7 tonnes. At present, 60 % of Indonesia is still forested, but the deforestation rate is one of the highest in the world, and deforestation is the largest source of CO₂ emissions, followed by rapidly rising emissions from the energy sector.

Box 2.2 Continues

Industrial emissions only account for a small proportion of the total. Illegal logging is the main reason why deforestation is not under control: it is estimated that 70–80 % of all Indonesian timber is felled illegally. Deforestation is also being driven by expansion of plantation operations and agriculture. Indonesia is giving high priority to expansion of its plantation sector, and the growing global demand for biofuels is putting further pressure on the remaining tropical rain forests. The provincial authorities in Kalimantan and Papua have already set aside large areas for such developments. Forest fires that are started deliberately are a serious problem at both national and regional level. Most fires are started to clear forest for agriculture, particularly for the production of palm oil.

The Indonesian authorities themselves have set the target of halving forest fires, which would result in a substantial reduction of the country's CO₂ emissions. In the negotiating process under the UNFCCC, a proposal has been put forward to provide compensation (carbon credits) for countries that prevent deforestation. If this is adopted and implemented, it could result in a reduction in the deforestation rate that would give considerable cuts in Indonesia's greenhouse gas emissions.

Norway is interested in closer cooperation with Indonesia on environmental and climate issues, and in strategic cooperation in international environmental forums where Indonesia plays an important role. Norway and Indonesia have recently signed a Joint Declaration on climate change and energy issues. This provides

for cooperation in various fields including CDM project activities, the development of renewable energy, political cooperation in climate change negotiations, research cooperation, reforestation projects and carbon capture and storage.

Norway is starting a new environmental cooperation programme in Indonesia in 2007. Its purpose is to reduce the extent of illegal logging and trade in tropical timber and to build up local forest management capacity. The programme addresses the problem of poor governance, which is an important underlying cause of deforestation.

In addition to making use of the flexibility mechanisms, the Government is participating actively in efforts to reduce emissions from the major developing country emitters, particularly China, India, Indonesia, South Africa and Brazil. Cooperation agreements have already been signed with some of these countries, focusing mainly on emission reductions. Norwegian business and industry can help to achieve cuts in emissions by providing expertise and technology. In future allocations of development funding, greater weight will therefore be given to cooperation on renewable energy sources and energy efficiency, transfers of technology for carbon capture and storage, private- and public-sector Norwegian investments in CDM projects, and research cooperation. Norway is also interested in closer political cooperation with these countries in climate negotiations. One possible measure in this context is support for the transfer of expertise to negotiators and experts from the countries in question.

trality initiative is another signal that the Secretary-General intends to lead the way and ensure that the UN is a key player in efforts to combat climate change. Norway has responded positively to the invitation to cooperate with the UN on this initiative. The details of the cooperation will be worked out shortly. The main purpose of the cooperation will be to support the UN's efforts to take the lead in this field, and to ensure that Norway, together with other countries and actors, makes progress in the quality assurance of efforts to reduce carbon intensity.

2.6 Climate issues and trade

The UN system, particularly the Intergovernmental Panel on Climate Change (IPCC), is and should be the main forum for efforts to ensure the broadest possible international support for reductions in greenhouse gas emissions. At the same time, we need to consider how other arenas, particularly the multilateral trade regime under the World Trade Organization (WTO), can be used to support the work being done in the main forum. It is important to ensure that the multilateral trade regime and efforts to deal with climate change are mutually reinforcing.

Box 2.3 Climate change in Africa

Africa is the continent that is contributing least to climate change, but will be hardest hit by its impacts. For example, various models indicate that if the temperature rises by 2 °C:

- Africa will suffer total losses of USD 133 billion, which corresponds to 4.7 % of GDP. Most of this will be in the agricultural sector
- 12 million people will risk starvation as a result of lower crop yields
- 20 million more people will be affected by flooding

If the temperature rises by 2.5–5 °C, the models indicate that:

- 128 million people will risk starvation
- 108 million more people will be affected by flooding
- The sea level may rise by 15–95 cm, causing flooding and mass migration. Banjul, the capital of Gambia, would for example be submerged

Adaptation to climate change is thus of crucial importance in Africa.

One of the areas in which negotiations are currently being conducted in the WTO is trade in environmental goods and services. Norway is seeking to promote such trade through the negotiations. However, as new climate-related measures are introduced, it will be necessary to improve knowledge of the links between such measures and the multilateral trade regime.

This means that it will be important to identify and make use of opportunities under the multilateral trade regime to promote and support climate-friendly measures and practices. On the other hand, it will be important to identify any factors that may result in distortion of competition between producers of the same goods and services in different countries, and that may unintentionally hamper trade in environmental goods and services. It is important to reach international agreement at an early stage on how to deal with such trade-related problems.

The first step should be to initiate an analysis of the links between climate-related measures and the trade regime. The OECD is the most suitable international arena for this. Norway will therefore suggest that the OECD, in cooperation with the WTO and other organisations as appropriate, should carry out an analysis of trade issues that arise in connection with the implementation of climate-related commitments. In the longer term, the goal should be to develop a basis for agreement on guidelines that are non-protectionist and will encourage trade in environmental goods and services and facilitate the transfer of climate-friendly technology to developing countries. Work on adaptation to climate change is also in progress in the OECD/DAC Network on Environment and Development Co-operation (ENVIRONET), where Norway is a member.

3 The Government's domestic climate policy

3.1 Policy instruments

General policy instruments are a central element of the Government's domestic climate policy. Cross-sectoral economic instruments form the basis for decentralised, cost-effective and well-informed measures to ensure that the polluter pays. When Norway has joined the EU emissions trading scheme, about 70 % of domestic emissions will either be covered by the emissions trading scheme or subject to the CO₂ tax. Certain sources of emissions cannot be incorporated into the emissions trading scheme or made subject to the CO₂ tax. In such cases, the authorities must use other instruments to reduce greenhouse gas emissions.

The Government's view is that further regulation should as a general rule be avoided in areas that are already regulated by means of general policy instruments.

However, the Government wishes to retain the possibility of using other policy instruments in addition to emissions trading and taxes in these sectors too. For example, the Government will use economic instruments and strengthen the promotion of new technology to make sure that new licences for gas-fired power plants are based on carbon capture and storage (CCS). Further examples of the use of other instruments are the doubling of Government support for new renewable energy developments, proposals for new building regulations and greater promotion of public transport and the railways.

The Government will review the tax system with a view to making changes that will promote environmentally friendly behaviour. This must be done within a revenue-neutral framework. The Government will maintain the overall tax level from 2004, and raised environmental and climate-related taxes will be offset by reductions in other taxes.

3.2 Current cross-sectoral climate policy instruments in Norway

The Government considers it important to continue the use of policy instruments that will ensure

the implementation of cost-effective measures across sectors. The Norwegian emissions trading scheme and taxes on emissions are cross-sectoral instruments that have been introduced specifically to reduce greenhouse gas emissions. The Pollution Control Act is also cross-sectoral, and in principle applies to greenhouse gas emissions, as discussed later. Both taxes and emissions trading put a price on activities and products that generate greenhouse gas emissions. Such instruments provide an incentive for producers and consumers to reduce their emissions, and encourage the development of environmentally sound technology. There are currently three Norwegian taxes that are explicitly linked to greenhouse gas emissions: the CO₂ tax, the tax on imports of chemicals containing hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), and the tax on final waste disposal. See chapter 6 for a presentation of climate-relevant policy instruments that target specific sectors.

Emissions trading scheme

The emissions trading scheme is one of the most important policy instruments for ensuring that Norway meets its Kyoto commitment. Norway has had an emissions trading scheme in place since 2005. On 25 May this year, the Government presented a proposal for the emissions trading scheme in the period 2008–2012 (Proposition to the Odelsting No. 66 (2006–2007) on amendments to the Greenhouse Gas Emission Trading Act).

The Government has decided that, on certain conditions, the Emissions Trading Directive is to be incorporated into the EEA Agreement, and therefore presumes that Norway will be integrated into the EU emissions trading scheme in period 2008–2012. Norway's domestic scheme is organised in accordance with the Emissions Trading Directive.

In the period 2008–2012, the emissions trading scheme will apply to more than three times the volume of emissions it covers in the period 2005–2007, and will cover more than 40 % of domestic emissions. This is because the oil and gas industry and those installations over 20 MW that currently pay

the CO₂ tax (pulp and paper, combustion installations, etc.) will be included in the system. The domestic emissions trading scheme already covers combustion installations over 20 MW (such as gas-fired power plants), refineries and the mineral industry (including production of cement and lime). Over time, the Government would like to see an emissions trading scheme with the widest possible scope, including as many sectors and countries as possible. The Government is therefore considering the inclusion of installations for which participation in the emissions trading scheme is not mandatory in the EU.

The Government considers it important that polluters are made responsible for the real costs of the pollution they generate. The polluter-pays principle is therefore also of crucial importance in the development of the Norwegian emissions trading scheme. The Government has decided that most of the emission allowances Norwegian installations need must be bought on the open market.

The Government does not intend to issue any allowances free of charge to the offshore sector. For land-based industries, allowances will be allocated free of charge on the basis of average emissions in the base years 1998–2001. The overall number of allowances allocated free of charge is to correspond to 92 % of average emissions in the base years. Installations will receive allocations corresponding to 100 % of their process emissions and 87 % of their emissions from energy use. In all, allowances allocated free of charge are expected to correspond to 25 % of the quantity needed for all installations covered by the emissions trading scheme. In addition, a reserve will be set aside for new gas-fired power plants that are based on CCS technology-ready and for licensed high-efficiency combined heat and power plants. The size of the reserve has not yet been determined, but it is assumed that the overall volume of allowances allocated free of charge will probably be of the order of 30 % of the volume needed by all the installations in the system, which is considerably less than in any other country in the EU emissions trading scheme. According to plan, installations included in the scheme will also, subject to further rules, be able to acquire emission units issued under the project-based Kyoto mechanisms, Joint Implementation and the Clean Development Mechanism, to comply with the requirements.

Taxes

The CO₂ tax is Norway's main policy instrument for reducing greenhouse gas emissions from sec-

tors and activities that are not included in the emissions trading scheme. About 52 % of Norway's greenhouse gas emissions and about 68 % of its aggregate CO₂ emissions are subject to the CO₂ tax. Use of mineral oil and petrol and emissions from the petroleum industry are currently subject to the CO₂ tax, but the tax rates vary. Table 3.1 shows the rates applicable in 2007. These vary from NOK 89 to NOK 342 when converted to rates per tonne CO₂. The process industry is in practice exempt from the CO₂ tax because coal, coke and use of gas in Norway are generally not taxed. Greenhouse gas emissions from the agricultural sector are not regulated by means of climate policy instruments.

The tax on imports of chemicals containing hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) is another instrument for pricing greenhouse gas emissions. The tax on these gases was introduced in 2003. The 2007 tax rate corresponds to about NOK 194 per tonne CO₂ equivalent, about the same as the CO₂ tax on mineral oils. Emissions of HFCs and PFCs are generated mainly from refrigerating equipment, fire fighting foam and the production of insulating materials. The tax applies both to HFCs and PFCs produced in Norway and to imported products. The Ministry of the Environment has established a refund scheme for HFCs and PFCs that are delivered for destruction. The refund corresponds to the tax rate for these substances.

Table 3.1 CO₂ tax rates for 2007

	NOK per 1/Sm ³ /kg	NOK per tonne CO ₂
Petrol	0.80	345
Mineral oils	0.54	
– light fuel oil, diesel		203
– heavy fuel oils		172
Mineral oils, lower rate	0.28	
– light fuel oil, diesel		105
– heavy fuel oils		89
Use of gas in Norway		
– natural gas	0.47	201
– LPG	0.60	200
Continental shelf	0.80	
– light fuel oil, diesel		300
– heavy fuel oils		255
– natural gas		342

Source: Statistics Norway and Ministry of Finance

The tax on final waste disposal also has a CO₂ component, which helps to reduce greenhouse gas emissions from landfills and waste incineration plants.

The emissions trading scheme and the various taxes mentioned here apply to just over 70 % of Norway's greenhouse gas emissions.

Pollution Control Act

Section 7 of the Pollution Control Act sets out a general duty to avoid pollution, which in principle applies to greenhouse gas emissions. The Norwegian Pollution Control Authority is responsible for administration of the Act. Current practice is that when a firm applies to engage in activities that can be expected to generate significant CO₂ emissions, these emissions are regulated in the firm's discharge permit. The limits set out in discharge permits correspond to projected emissions from the installation, and therefore do not entail real requirements to reduce emissions. This is partly because greenhouse gas emissions are to a large extent regulated by other instruments such as the CO₂ tax, the emissions trading scheme and agreements with specific industries. However, the Government would like to emphasise that the Pollution Control Act applies to greenhouse gas emissions, and that it is therefore an important climate policy instrument as well. This is laid down both by the Pollution Control Act and by the Greenhouse Gas Emission Trading Act.

An installation that generates CO₂ emissions that are subject to the Greenhouse Gas Emission Trading Act must also hold a discharge permit pursuant to the Pollution Control Act for these emissions. Such discharge permits may include requirements relating to energy efficiency and the use of specific technology. Requirements pursuant to the Pollution Control Act are also used to reduce methane emissions from landfills.

Climate awareness campaign

The Government also considers it important to create understanding of the need to reduce greenhouse gas emissions and inspire people to play a part in these efforts. The Ministry of the Environment, in cooperation with a wide range of other actors, has therefore started a major climate awareness campaign («Klimaløftet») that targets individuals, firms and local and central government. An important element of the campaign is to provide information on opportunities for change. It is based on factual information and cooperation

with research institutions. Various initiatives have been taken as part of the campaign, including the establishment of a web portal, a nationwide series of lectures, and arrangements tailored to business and industry.

3.3 Effectiveness and cost effectiveness

Effectiveness and cost effectiveness are two key criteria in environmental policy development, as in other policy areas.

The *polluter-pays principle* is an important element of environmental policy. It lays down that the polluter should bear the costs of environmental damage.

The *effectiveness* of policy instruments is measured by how reliably they lead to the achievement of policy targets. This is particularly important in relation to international commitments. In this case, the effectiveness of policy instruments to reduce greenhouse gas emissions is linked to whether Norway succeeds in complying with its Kyoto commitment by means of a combination of national measures and use of the Kyoto mechanisms. Effective policy instruments are also needed to ensure the implementation of new technology that has not yet been commercialised.

Cost *effective* policy instruments result in the implementation of measures that give the greatest possible emission reductions relative to the resources used. If policy instruments are not cost effective, society must accept an unnecessary loss of welfare in other areas in order to achieve environmental goals.

Climate policy instruments can be made cost effective by giving decision-makers in all sectors of society the same incentive to reduce greenhouse gas emissions. A cross-sectoral environmental tax is in principle a cost-effective policy instrument. The authorities often lack information on which measures are most effective. A cross-sectoral tax leaves the choice of measures to the actors themselves. The effectiveness of a tax depends on whether the tax rate is high enough and the tax sufficiently precisely targeted to trigger the necessary adaptations by firms and households. Taxes are determined annually, giving the authorities the opportunity to correct discrepancies between actual and projected emissions.

In a system with tradable emission allowances, a carbon price is formed that gives actors within the system the same incentive to reduce emissions. The emissions trading scheme can therefore

in principle also be designed as a cost-effective policy instrument. However, for the scheme to be cost-effective, it must be designed in such a way that actors are given effective incentives to cut their emissions. The effectiveness of the scheme can be ensured by capping the total volume of emission allowances at a level that will allow the environmental target to be met. The price of allowances is determined by supply and demand. If an emissions trading scheme is not purely national, as in the case of the Norwegian scheme linked to the

EU scheme, its effectiveness with reference purely to emissions from installations in Norway that are covered by the scheme cannot be measured.

International emissions trading can be instrumental in forming a common international price for greenhouse gas emissions and ensuring cost effectiveness across national borders. Since reducing greenhouse gas emissions has the same effect regardless of where in the world cuts are made, global cost effectiveness should be given high priority in climate policy.

Table 3.2 Effects of Norwegian policy instruments implemented after 1990 (million tonnes CO₂ equivalents)

	1995	2000	2003	2005	2010
<i>Climate-specific policy instruments</i>					
CO ₂ tax offshore ¹	0.6	3.0	3.0	3.0	3.7 ³
CO ₂ tax onshore ²		0.8	0.8	0.8	0.8 ³
Requirement to collect landfill gas	0.25	0.4	0.45	0.5	0.6
Other instruments in the waste sector		0.07	0.2	0.25	0.4
HFCs – tax and recovery			0.2	0.3	0.5
Agreement with aluminium industry ⁴	0–1.6	0.6–3.0	1.2–4.0	1.4–4.0	1.4–4.1
Agreement on reduction of SF ₆ emissions			0.05	0.06	0.06
<i>Other policy instruments</i>					
Regulation of VOC emissions offshore			0.17	0.2	0.25
Regulation of VOC emissions at the Sture terminal		0.01	0.17	0.02	0.005
<i>Voluntary reductions</i>					
Reduction of SF ₆ emissions from magnesium production	1.0	1.4	0.5 ⁵	0.5	0.5
Reduction of N ₂ O emissions from nitric acid production	0.4	0.3	0.3	0.3	0.3
Use of biocarbon in cement production		0.02	0.03	0.1	0.1
Total effect of instruments included in reference scenario	2.3–3.9	6.6–9.0	7.1–9.9	7.4–10.0	8.5–11.1
<i>New policy instruments after 2004</i>					
Emissions trading 2005–2007				0–0.5	0–0.5 ⁶
Arrangement with process industries					0.6
Instruments in waste sector					0.15
Total emission reductions	2.3–3.9	6.6–9.0	7.1–9.9	7.4–10.5	9.3–12.4

¹ Based on a report from operating companies on the Norwegian continental shelf and the Norwegian Pollution Control Authority.

² CO₂ tax offshore will be changed from 2008 when the petroleum sector is included in the emissions trading scheme.

³ Based on an equilibrium analysis for 1990–1999. Bruvoll A. and B.M. Larsen (2004) *Greenhouse gas emissions in Norway. Do carbon taxes work?* Energy Policies 32 (4), 493–505, and an assessment carried out for Norway's Third National Communication under the UNFCCC.

⁴ The lower figures reflect direct effects of the agreement, while the higher figures include measures carried out before the agreement was concluded in 1997.

⁵ Partial closure of a factory in 2001 resulted in emission reductions that are not included in the calculations.

⁶ From 2008, the emissions trading scheme will result in further reductions.

It is easier to gain broad political acceptance for cost-effective measures, and cost-effective implementation can make it easier to reach agreement on more ambitious international targets. The UN Framework Convention on Climate Change (UNFCCC) emphasises that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.

Dealing with the challenges of climate change requires a very long-term perspective. Policy instruments must be assessed in the same perspective. The developed countries' greenhouse gas emissions must be substantially reduced by the middle of the present century. The costs of such reductions will probably be far higher than the current carbon price, but long-term decisions do not necessarily take sufficient account of the long-term climate policy framework. The problem is partly that it is uncertain what the framework will be, and partly that decision makers do not currently have strong enough incentives to take future circumstances into account. It is therefore important for the authorities to ensure that their climate policy targets enjoy credibility, and to provide information on probable trends in carbon prices and climate-related taxes. This will enable private actors to use the best possible price estimates, for example in making decisions on investments.

The development of climate-friendly technology involves special challenges. The results of research and development are to a large extent a public good that everyone should be able to use freely. However, due to the difference between micro- and macroeconomic assessments of profitability, the level of private-sector research and development will normally be too low. Uncertainty about future carbon prices may amplify this market failure. This implies that the state should subsidise the development and testing of new technologies, and perhaps the early stages of their commercialisation, in order to reduce this uncertainty and achieve positive external effects in the form of the spread of climate-friendly technology. This is why the Government has decided to contribute funding towards the development of carbon capture and storage technology. Projects in this field are not profitable at present given current cost levels, but may be in the future. In this case, Norwegian expertise and technology may become an important export article, and by helping to make this technology available at an earlier stage, we can also make an important contribution to reductions of CO₂ emissions throughout the world.

Many market decisions and decisions by the public sector have only short-term consequences. Others create structures that remain in place for many years. It is important, for example, to ensure that buildings, urban structure and the transport system are properly adapted to long-term energy- and climate-related requirements. Decisions that will have long-term effects must take climate change into account to a greater degree than is suggested by current carbon prices. The projected rise in climate-related costs must be included as part of the basis for decisions on such investments, and for analyses and decisions on the tax system and on state aid to industries that will affect land use and infrastructure.

The price signals provided by taxes and carbon prices will not necessarily have the same effect in all sectors or on all actors, and they may therefore need to be supplemented with other policy instruments. One example is the Planning and Building Act and regulations under the Act. Even if the authorities provide satisfactory information, it may be unreasonable to expect individuals to take full account of probable changes in climate policy and the rise in energy prices this will involve. This means that regulating energy use in buildings can be an economically sound measure. Another example is the CO₂ component of the purchase tax on cars, which provides an extra incentive to make an environmentally sound choice by giving information on differences in emission levels and the CO₂ tax levels at the time of purchase.

A framework that ensures sufficiently high carbon prices and taxes is the mainstay of climate policy. The sectors mainly responsible for greenhouse gas emissions have identified measures that will result in cost-effective emissions reductions that are not currently being implemented in these sectors. Some of the measures will be implemented directly through decisions by the authorities. Further analyses and experience will be needed to assess which measures will be carried out in response to taxes or the emissions trading scheme, and where other policy instruments will be needed.

Table 3.2 shows the range of policy instruments that has been used to bring about emission reductions in Norway so far.

3.4 National target for 2020

The Government will implement measures to reduce emissions substantially both in Norway

and in other countries. In the Government's view, both these approaches are valuable.

At present, emissions are roughly equally split between developed and developing countries. Emission reductions in Norway and other developed countries will be of crucial importance in achieving global cuts in greenhouse gas emissions that are sufficient to avoid dangerous interference with the climate system. To ensure that the necessary restructuring process in Norway is not delayed or obstructed, we will continue our focus on substantial domestic measures. Norway started to carry out climate-related measures at an early stage, and these have already yielded substantial reductions. One example is the reduction of emissions from the petroleum industry on the Norwegian continental shelf. Continuing and intensifying this restructuring process will be the most economically profitable option in the long term. Moreover, a number of scientific reports, including the Stern Review, have shown the costs of not taking early action to avoid climate change will probably be several times higher than those of taking action, partly because society will then have to deal with greater climate change.

International leadership is important to advance negotiations within the framework of the UNFCCC and the Kyoto Protocol. The negotiations have been at a standstill for several years, and there has been a constant risk that they will break down. One prerequisite for progress in the negotiations is for more developed countries to show willingness to take action at home. If Norway is to succeed in playing a leading role in the international negotiations, we too must take action to cut emissions substantially within the country. Measures carried out in other countries can bring about large cost-effective cuts in emissions, and provide additional gains in the form of the transfer of economic resources. If developing countries and countries with transition economies are to be willing to participate in an ambitious climate agreement in the future, the rich countries must assume a considerable share of the financial burden of emission reductions in poor countries. Measures carried out in poor countries will both provide climate-related benefits and reduce local pollution. They will thus provide economic benefits for these countries. Efforts to reduce greenhouse gas emissions are closely linked to poverty reduction efforts.

According to the Fourth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC), greenhouse gas emissions must be cut by 50–85 % globally to avoid dangerous interference with the climate system and limit the aver-

age rise in temperature to 2.0–2.4 °C. The Government has adopted the goal of limiting the average rise in global temperature to no more than 2 °C above the pre-industrial level. A strategy developed for the period up to 2020 must therefore take into account the need to be able to make even more ambitious cuts in emissions in the period 2020–2050.

In the long term, Norway must become a low-emission society. Given a more concerted international effort to reduce greenhouse gas emissions and the projected rise in carbon prices, it will become economically profitable to carry out a range of measures at national level. The Government will in particular consider measures that will be cost effective with a projected rise in carbon prices over the lifetime of the investment, and that will not necessarily be implemented in response to current policy instruments. In this connection, priority will be given to measures that promote technological developments. Measures may also be considered to encourage the population as a whole to begin a changeover to a low-emission consumption pattern sooner than they would as a result of the projected rise in carbon prices alone.

It is only possible to provide an estimate of the proportion of Norway's emission reduction commitments that will be achieved through domestic reductions and the proportion that will be achieved in other countries through the Kyoto mechanisms, including emissions trading and the Clean Development Mechanism. This is partly because Norway is to join the EU emissions trading scheme from 1 January 2008. The emissions trading scheme will then apply to at least 40 % of Norwegian emissions. Firms that are included in the emissions trading scheme are required to reduce emissions, but are free to decide whether to do this by cutting their own emissions or by funding emission reductions in other firms by purchasing emission allowances. Thus, in an emissions trading scheme, the authorities determine the overall level of emissions, but not where cuts are to be made. There is also considerable uncertainty as regards projections of trends in the Norwegian economy, technological developments and the costs of carrying out measures in other countries. This makes it difficult to determine exactly how much emissions will be reduced in Norway.

Since 1990, greenhouse gas emissions in Norway have risen by almost 9 %. According to preliminary figures from Statistics Norway and the Norwegian Pollution Control Authority, emissions totalled 53.7 million tonnes CO₂ equivalents in 2006. In the 2007 national budget, greenhouse gas

emissions in both 2010 and 2020 were estimated at just under 59 million tonnes CO₂ equivalents. These figures have been adjusted in accordance with the most recent methodological changes in the emission inventory, which also have implications for projections of emissions. The trend in emissions must be seen in the context of the expected reduction in emissions from the petroleum industry in the period up to 2020.

Norway started to implement climate-specific policy measures at an early stage. These have resulted in sharp reductions in emissions. In Norway's Third National Communication to the UNFCCC, published in December 2005, it was estimated that in 2020, emission reductions due to measures implemented since 1990 will be about 11 million tonnes CO₂ equivalents (see table 3.2). Continued application of current policy instruments, including the CO₂ tax, in the years ahead will result in further emission reductions. On a somewhat uncertain basis, it is estimated that without the measures implemented after 1990, greenhouse gas emissions in Norway would reach 75–80 million tonnes CO₂ equivalents in 2020. This estimate is based on the assumption that rising domestic electricity demand up to 2020 is met in the cheapest way, i.e. using electricity generated from gas in Norway, without carbon capture and storage.

Norway will undertake to reduce global greenhouse gas emissions by the equivalent of 30 % of its own 1990 emissions by 2020, see Chapter 1. This means that emissions must not exceed 35 million tonnes CO₂ equivalents in 2020, when emissions trading and carbon uptake in forests are taken into account. This is about 15 million tonnes below the 1990 level, and almost 20 million tonnes lower than in 2006.

It is not possible at present to obtain reliable figures for the emission reductions that will be achieved through existing and new measures in the next 10–15 years (see the discussion above). Nor do we know which emission reduction measures will be implemented in Norway in the period up to 2020. This will depend among other things on technological advances and trends in carbon prices. Moreover, developments on the Norwegian continental shelf will be particularly important for emission levels in Norway in 2020. In the 2007 national budget, greenhouse gas emissions in 2020 were estimated at about 59 million tonnes CO₂ equivalents. This estimate is based on uncertain figures. Experience shows that the figures in a reference scenario of this kind are often altered as time goes on. On the basis of the mitigation analy-

sis drawn up by the Norwegian Pollution Control Authority, sectoral climate action plans and current policy instruments, the Government considers that a realistic target is to reduce Norwegian emissions by 13–16 million tonnes CO₂ equivalents relative to the reference scenario presented in the National Budget for 2007, when CO₂ uptake by forests is included. In this case, from about half and up to two-thirds of the cuts in total emissions by 2020 would be made in Norway. The adoption of a new international climate agreement will make it necessary to revise national targets and instruments. If emission trends indicate that Norway will not achieve its targets, the Government will consider further measures.

3.5 Mitigation options for Norway and the associated costs

The Ministry of the Environment commissioned the Norwegian Pollution Control Authority to analyse mitigation options for the years ahead. The mitigation analysis that has been published is an update of the catalogue of measures the Pollution Control Authority drew up in 2005, and focuses on technical measures to reduce Norway's greenhouse gas emissions up to 2020.

The projections published in the 2007 national budget were, with some adjustments, used as a basis for assessing the measures. These projections are based on the assumption that there will be an annual improvement in energy efficiency. To take this into account, the estimated emission reductions from measures designed to improve the energy efficiency of transport and stationary energy use have been reduced in the updated analysis.

Both the cost estimates and the emission reductions in the analysis are uncertain, and there is little discussion of the specific policy instruments needed to encourage implementation of the mitigation options. The Pollution Control Authority also points out that by 2020, there will probably be new technological solutions and a different set of framework conditions that may reduce costs and offer opportunities to reduce emission more than the analysis suggests.

The Pollution Control Authority's mitigation analysis is a «bottom-up» analysis and is particularly useful as a basis for assessing what measures and restructuring processes, if any, are available for specific sectors in a long-term perspective, but will not be triggered by the general policy instruments. Certain measures may also require direct

legislative measures by the authorities: see the discussion in section 3.3. However, the analysis does not take into account the macroeconomic effects of the costs of the mitigation options. Calculations based on macroeconomic models (using a «top-down» approach) do in principle take these effects into account. In its Fourth Assessment Report, the IPCC emphasises that both approaches are useful as a basis for drawing up climate policy.

The overall technical mitigation potential is about 20 million tonnes CO₂ equivalents, calculated relative to projected emissions of 59 million tonnes CO₂ equivalents in 2020 in the reference scenario, and taking into account the assumptions on which the analysis is based. This includes all measures, from those that may be difficult to implement because they involve many different actors or require considerable technological advances, to those that are technically feasible despite their cost. Costs and feasibility were assessed for all measures. The Pollution Control Authority assessed the feasibility of measures on the basis of existing policy instruments and technology.

According to the Pollution Control Authority, the analysis does not to any great extent include options involving major social change, changes in production levels, or changes in behaviour. The calculations show that emission reductions of 6.5 million tonnes CO₂ equivalents could be achieved by implementing measures that cost less than NOK 200 per tonne. Emission reductions totalling 14.4 million tonnes CO₂ equivalents in 2020 could be achieved by including measures with a cost of up to NOK 600 per tonne.

The mitigation analysis shows that there are many measures with a cost of less than NOK 200 per tonne, which is equivalent to the current CO₂ tax on light fuel oils. It may seem surprising that such measures have not already been implemented to a greater degree. The fact that they have not may suggest that the costs appear higher from a consumer standpoint. One reason may be that it is difficult to estimate the costs of certain barriers to implementation.

3.6 Discussion of the costs associated with an ambitious climate policy

An ambitious international climate policy will reduce the risk that climate change will cause serious adverse effects, for example through a rise in sea level, a shift in temperature zones, and a rise in the frequency of extreme weather events. At the

same time, the Norwegian economy will also be affected by the responsibility Norway accepts for reducing emissions and through changes in the value of Norwegian exports and imports.

A reduction target of 30 % relative to the 1990 level means that Norway's emissions must not exceed 35 million tonnes CO₂ equivalents in 2020, when emissions trading is taken into account. This is about 15 million tonnes below the 1990 level, and about 20 million tonnes lower than the estimate for 2020 in the 2007 national budget.

It is difficult to give precise estimates of costs associated with emission reduction measures in Norway and of future carbon prices. The EU has recently estimated that the global price of carbon in 2020 will be EUR 37 per tonne CO₂ equivalent (about NOK 300), in a scenario with an ambitious international climate agreement that involves reducing emissions in developed countries by 60 % relative to the 1990 level. This is also in accordance with the price trend estimated in the Stern review in a scenario where the concentration of greenhouse gases in the atmosphere is stabilised at around 550 ppm. On the basis of an average carbon price of NOK 300 and total emission reductions of about 25 million tonnes, the costs of achieving the Government's 30 % reduction target are estimated at about NOK 7.5 billion in 2020. Some of the national measures the Government has already initiated will cost more than NOK 300 per tonne emission reduction. In its mitigation analysis, the Norwegian Pollution Control Authority also listed a number of national measures that would cost less than this.

According to calculations by the Norwegian Pollution Control Authority and the Low Emission Commission, it is possible to reduce emissions in Norway substantially without incurring significant economic costs. However, various other calculations, for example by the European Commission and in new studies of the costs of reducing British greenhouse gas emissions, suggest that large cuts in emissions will involve major costs. In its Fourth Assessment Report, the IPCC estimates the costs of limiting the average rise in global temperature to no more than 2°C above the pre-industrial level at just under 3 % of global GDP in 2030 and about 5.5 % in 2050.

The Ministry of Finance has also modelled the situation for Norway using the macroeconomic model MODAG, and the results indicate that the costs of large national cuts in emissions will be substantial. These calculations indicate that, given effective use of policy instruments, it will be possible to reduce greenhouse gas emissions in Norway

by about 10 million tonnes in 2020 at a cost corresponding to about one per cent of mainland GDP. For 2007, this means about NOK 16 billion. However, such calculations are very uncertain. They depend among other things on the capacity for economic restructuring in Norway, i.e. how long Norwegian producers, employees and other actors need to adapt and implement measures. As the Norwegian economy is restructured, the costs of the measures will be reduced.

International measures to reduce greenhouse gas emissions, for example higher taxes or binding emission allowances, may influence global consumption of fossil fuels. Lower demand and higher tax wedges in consumer countries might in isolation reduce producer countries' revenues from oil and gas production. However, trends in oil prices will also depend on how the OPEC countries respond to such a change in market conditions.

Norway will contribute to the development of technology for carbon capture and storage. If the costs of using this technology drop sufficiently, it can make a significant contribution to reducing CO₂ emissions even without a corresponding drop in the demand for fossil energy carriers. This is an example of why the effects of an ambitious international climate agreement on energy prices are very uncertain.

3.7 The Norwegian Commission on Low Emissions

3.7.1 About the Low Emission Commission

The Low Emission Commission was established by the Government in March 2005, with the following mandate:

«The Commission's main task is to review how Norway can achieve significant cuts in domestic greenhouse gas emissions in the long term – a 'national climate vision for 2050'. The Commission is to review various scenarios describing how a low-emission society can be developed over the next 50 years. These should include scenarios in which domestic greenhouse gas emissions are reduced by 50–80 % by 2050. The Commission should focus mainly on opportunities for developing and using new technologies. This will include considering which measures will be required to fully develop the potential of technological innovations. Key development trends must be evaluated on the basis of the opportunities they provide for developing a low-emission society. Opportunities for emission reductions in all relevant sectors must be considered. In addition, the Commission should

as far as possible assess the costs and other consequences of the different scenarios, including in a macroeconomic perspective, and compare the costs of reducing emissions in Norway with the costs of similar reductions in other countries. The Commission must establish a range of contacts and engage in dialogue with civil society. It is important to include relevant researcher communities and other experts in the process. This can be done through debates, public hearings and by inviting input through web-based consultations. The Commission's conclusions are to be presented in the series Official Norwegian Reports. The Commission's work has a time frame of 18 months.»

The Commission presented its report (NOU 2006:18) on a climate-friendly Norway on 4 October 2006. Its main conclusion is that reducing Norwegian emissions by about two-thirds by 2050 is necessary, feasible and not prohibitively expensive.

The Commission's mandate did not include making proposals for policy instruments to ensure that its proposed measures are implemented.

The Government intends Norway to take its share of the responsibility for reducing global emissions to a level at which we will avoid the most serious impacts of climate change. In the long term, Norway must become a low-emission society. The policy instruments needed to ensure that the necessary measures are implemented, and the costs of applying these instruments, should be further reviewed.

There is bound to be uncertainty associated with recommendations with such a long time horizon as the Commission was asked to consider. The Commission itself points out that most technical equipment will be replaced during a period of 40–50 years. The technology available and choices of technological solutions will have a major impact on future emissions. It is also generally difficult to predict the scale of restructuring of business and industry that will be needed to achieve a low-emission society by focusing only on emission reductions in Norway.

A public consultation on the Commission's report was held, with a deadline for comments of 27 February 2007. More than 90 answers were received, and there was wide support for the Commission's overall solution. There was also general agreement on the conclusion that it is possible to achieve emission cuts of the order considered by the Commission. Some of the bodies consulted considered the potential for emission reductions to be greater than the Commission concluded because measures that require changes in people's

attitudes were not evaluated, while others considered the estimated emission reduction potentials of the technical measures evaluated by the Commission to be too low. Some bodies criticised the Commission's mandate, and others suggested the inclusion of measures not evaluated by the Commission. Various bodies also pointed out that the report does not to any great extent compare the costs of emission reductions in Norway with those of similar emission reductions in other countries.

Some researchers have criticised the assumptions on which the Low Emission Commission based its analysis. For example, the Commission assumes that considerable technological advances

will be made, and proposes a major research and development initiative and demonstration projects, but does not take the costs of this initiative into account. The Commission also assumes that the scale of measures adopted by other countries will not be such that they have an effect on technological developments internationally. Some of the consultation bodies suggested that technological developments on the scale the Commission assumes would require the introduction of extensive measures to reduce greenhouse gas emissions in other countries as well. The Commission itself states that there is considerable uncertainty as regards the costs of its proposed package of mit-

Table 3.3 Overall solution proposed by the Low Emission Commission

Sources of emissions		Measures
Basic measures	1	Initiating a long-term national climate awareness campaign; providing objective, factual information about the climate problem and what can be done about it.
	2	Promoting the development of climate-friendly technologies through long-term, stable support for the Commission's technology package. This focuses on carbon capture and storage (CCS) technologies, wind power (especially offshore), pellet stoves and clean-burning wood stoves, biofuels, solar cells, hydrogen technologies, heat pumps and low-emission ships.
Transport	3	Phasing in low- and zero-emission vehicles such as hybrid vehicles, light diesel vehicles, electric vehicles and fuel cell vehicles.
	4	Phasing in CO ₂ -neutral fuels such as bioethanol, biodiesel, biogas and hydrogen.
	5	Reducing transport needs through improvements in logistics and urban planning.
Heating	6	Developing and phasing in low-emission vehicles.
	7	Increasing energy efficiency in buildings through stricter building standards, eco-labelling and grant schemes.
Agriculture and landfills	8	Bringing about a transition to CO ₂ -neutral heating through greater use of biomass, more effective use of solar heat, heat pumps, etc.
	9	Recovering methane from manure pits and landfills and using it for energy purposes.
Process industries	10	CCS at industrial plants with large point emissions.
	11	Carrying out process improvements in energy-intensive manufacturing.
Petroleum industry	12	Electrification of installations on the continental shelf and increasing the proportion of installations sited onshore.
Electricity production	13	Providing more «new renewable» electricity by expanding wind power and small hydropower plants.
	14	Implementing CCS at gas- and coal-fired power plants.
	15	Upgrading the electricity grid and improving its efficiency to reduce grid losses and give small power plants better access to the grid.

igation measures. The Commission's cost estimates are lower than those in international studies (which indicate that emission cuts of the order proposed by the Commission will cost around one per cent of GDP). The Commission's report points out that it was difficult to find good estimates of the costs of three of the measures included in the low-emission scenario. These are improving energy efficiency in residential and non-residential buildings and reducing emissions from the transport sector.

3.7.2 The Low Emission Commission's recommendations

The Commission identified what it considers to be the major sources of Norwegian emissions in 2050 and drew up recommendations for reducing these emissions. The Commission drew up a reference scenario based on a number of assumptions, under which Norway's emissions would rise further to an

estimated 69 million tonnes CO₂ equivalents in 2050. This corresponds to an increase of almost 40 % relative to the 1990 emission level.

In drawing up recommendations for the measures that should be implemented to achieve emission reductions in the order of 50–80 % by 2050 relative to the current level, the Commission considered it important that the measures should meet a number of criteria. These were that they should

- be few and on a large scale
- be based on relatively well known technology
- be politically feasible
- contribute to international advances in technology
- be cost effective, i.e. not unreasonably costly in relation to the emission reductions they were to deliver
- be robust with respect to various assumptions on future trends in the economy, trade, energy prices, climate agreements and so on.

Table 3.4 The necessary first steps proposed by the Low Emission Commission

1	Initiating a climate awareness campaign. Long-term government support for information about the climate problem and how individuals can help to reduce emissions without reducing the quality of their lives.
2	Supporting the technology package proposed by the Commission and the technology initiative recommended by the climate research committee appointed by the Research Council of Norway. This involves large, long-term allocations to priority research tasks, including research to improve understanding of decision-making procedures related to climate measures.
3	Further developing technological innovations through the establishment of pilot and demonstration projects.
4	Implementing CCS at all gas- and coal-fired power plants.
5	Phasing in low- and zero-emission vehicles, using vehicle taxes with a better environmental profile (registration tax, road tax, etc.), government purchases of biofuels and the introduction of minimum requirements for sales of biofuels (at least 5 % of sales by 2009).
6	Promoting CO ₂ -neutral heating by means of grants for heating systems based on biofuels and heat pumps and the introduction of a refund scheme for old oil- and gas-fired boilers.
7	Promoting energy efficiency by means of stricter building standards for energy use per m ² in buildings.
8	Establishing clear, stable, long-term grant schemes for the development of renewable energy sources to replace the green certificate scheme that was proposed but not implemented. Energy delivered to the heating market must be included.
9	Encouraging climate-friendly public procurement through comprehensive motivation and training programmes for relevant groups of employees and stricter enforcement of the rules for public procurement.
10	Preparing sectoral action plans and proposals for policy instruments to achieve the goal of making Norway climate-friendly (a task for the ministries).
11	Working actively for further development of the EU emissions trading scheme and emissions trading under the Kyoto Protocol, and encouraging more countries and sectors to accept binding emission commitments.

The overall solution proposed by the Commission consists of 15 measures, which are listed in table 3.3.

The Commission also recommended that some measures should be implemented in the current parliamentary period, i.e. before 2009. These necessary first steps are listed in table 3.4.

The economic costs of carrying out the Commission's recommendations have been calculated, and it is estimated that the overall effect on GDP and private consumption in 2050 will be less than +/-0.5 % relative to the levels in the reference scenario. This estimate is uncertain, among other things because the Commission has not specified which policy instruments will be necessary, but has to a large extent assumed that the necessary emission reductions will be achieved by making use of new technology.

The Government has already taken initiatives in line with several of the necessary first steps listed by the Commission. The sectoral climate action plans are presented in this white paper. The Government will use economic instruments and strengthen the promotion of new technology to make sure that new licences for gas-fired power plants are based on carbon capture and storage, as set out in the budget proposal for 2006. Conditions

laid down in the discharge permit issued by the Ministry of the Environment on 12 October 2006 and the agreement between the State and Statoil on carbon capture and storage at Mongstad provide a basis for construction of a carbon capture facility at the Mongstad power plant. The Government has also started to restructure vehicle taxes to improve their environmental profile and has introduced stricter energy use requirements under the Planning and Building Act. Furthermore, NOK 10 billion has been allocated to a fund for the promotion of renewable energy and energy efficiency measures, and from 1 January 2008, there will be feed-in arrangements for renewable electricity instead of the green certificate scheme that was previously proposed. The Government will launch an action plan for environmentally sound public procurement, and last spring a climate awareness campaign (Klimaløftet) was launched. The national climate research initiative mentioned in point 2 of table 3.4 is further discussed in Chapter 5. Chapter 6 describes the Government's proposals for new measures in various sectors of society. Internationally, Norway is working actively to initiate the process towards further emission cuts and a more comprehensive climate change regime after 2012.

4 Following up the Government's climate targets and climate action plans

The Government intends to make five-yearly reviews of progress and how the use of policy instruments at national level should be further developed. As part of the review process, the Government will commission independent expert analyses of Norwegian climate policy from institutions and/or people with wide experience and knowledge of the development and implementation of climate policy. These analyses will consider Norway's climate targets and the progress that has been made towards achieving them. They should also consider the application of policy instruments, the measures taken in response to these, and their costs. The analyses should also recommend ways of improving climate policy and making it more effective. In the Government's view, a good model for this process may be to ask institutions in other countries to carry out peer reviews, since satisfactory results have previously been obtained

through peer reviews of both environmental and other issues.

The Government proposes that an evaluation of climate policy and how policy instruments should be modified should be submitted to the Storting midway through the first Kyoto period (in 2010). Furthermore, the Government will ensure that whenever matters are being prepared for consideration by the Storting or the Government, evaluation of any impacts on the climate is given higher priority than at present. This should be viewed in connection with the Government's intention that there should generally be more awareness of the effects of policy measures on sustainable development.

Moreover, the Government will report on trends in emissions and the implementation of climate policy in connection with the ordinary budgetary processes, for example when following up the sustainable development strategy.

5 Research and monitoring

The Government will:

- intensify the climate-related research effort in the years ahead as part of its research policy
- give priority to monitoring of climate processes and the impacts of climate change in the High North.

5.1 Climate research and the development of technology

5.1.1 Strengthening climate-related research

In its policy platform, the present Government announced that it would strengthen climate-related research and the development of environmentally sound energy technology. In addition, a broad-based climate related research initiative was one of the measures recommended by the Low Emission Commission. By focusing on knowledge generation and the development of new technology, we can give our national efforts importance far beyond Norway's borders. Moreover, as a rich energy producer, Norway has a special responsibility for seeking to achieve advances in knowledge and technology that will help to mitigate climate change. The issue of climate change is so complex that new knowledge is needed in many areas. We also need to generate knowledge that could be used to find solutions to future problems. Better knowledge of the causes and impacts of climate change will form an important basis for future negotiations on climate agreements, and will provide the scientific basis for political decisions on how much emissions need to be reduced. Furthermore, the development of new technology for energy production and use is a very important element of efforts to reduce greenhouse gas emissions in Norway and internationally. Climate and environmental research is also a high priority in other countries and in international cooperation forums. Two of the themes of the EU's Seventh Framework Research Programme are environment (including climate change) and energy, and these have a total budget framework equivalent to about NOK 34 billion for the period 2007–2013.

This is why the Government is proposing to strengthen climate-related research and research and development related to environmentally sound energy technologies, including the use of renewable energy sources and carbon capture and storage.

Research on the climate system and climate change is of key importance for ensuring that we have a sound knowledge base for predictions of future climate change and its impacts. However, climate-relevant research includes much more than this. Other examples of fields that are important in ensuring that climate policy is knowledge based are research and development of climate-friendly technology, especially related to renewable energy and energy efficiency; social science research on policy instruments and measures; and research on the vulnerability of society to climate change and the need for adaptation. Research on social trends (for example population, technological level and resource consumption) and how these trends result in changes in greenhouse gas emissions is included as well. It is also important to learn more about which policy can provide optimal solutions for dealing with climate change on the scale believed to be inevitable. In addition, more knowledge is needed about adaptation measures and vulnerability in developing countries.

To ensure that we can benefit from research results, it is essential that they are communicated to the authorities, politicians, the business sector and the general public. The Research Council of Norway, the Norwegian Pollution Control Authority, the Center for International Climate and Environmental Research (CICERO) and other relevant research institutions have a key role to play in dissemination of knowledge relating to the climate. CICERO has been given a national responsibility for providing information on climate change issues and for disseminating research results. International efforts, particularly under the UN Intergovernmental Panel on Climate Change (IPCC), are also very important in this context. The Government emphasises that it will be a key task in the time ahead to improve communication of information on climate issues, and that all R&D institutions working on climate-relevant topics should give priority to dissemination of their results.

Research on climate, the environment and energy bridges disciplinary, sectoral and administrative boundaries. It is therefore a joint task for the whole Government to create momentum in this area. The Ministry of Education and Research, which is responsible for coordinating research policy, and the Ministry of the Environment, which is responsible for coordinating environmental policy, share the responsibility for realising a joint initiative for climate-related research. It is also important to encourage more user-funded research in this field, in which research areas and opportunities are defined in cooperation with the business sector, which also has an ambition to put new climate and environmentally friendly technology on the market.

Norway has a special position in international climate research because of its geographical situation. The Gulf Stream results in a much warmer climate in Norway than would be expected given its northerly latitude. Climate processes in the polar regions are of key importance for the global climate system, and thus for climate trends. Our engagement in the High North gives us a unique opportunity to obtain new knowledge and contribute to international research results. Climate change is taking place more rapidly in the polar regions than in the rest of the world. It is therefore important to obtain better, continuous time series of parameters such as temperature, ocean currents and ice thickness. This can give a deeper understanding of the scale and speed of climate change. Maintaining long time series properly requires a long-term commitment.

Norway has technological advantages that can be important in efforts to reduce greenhouse gas emissions. We have more than 10 years' experience of carbon capture and storage on the Sleipner field in the North Sea, and thus have important knowledge that can be used to reduce CO₂ emissions from the use of fossil fuels. The projects for carbon capture and storage at the Mongstad power plant and the Kårstø gas-fired power plant will give us further experience and help to reduce the costs and risks associated with establishing such facilities. Implementation of the Kårstø and Mongstad projects will play an important role in demonstrating that this technology can play a vital role in reducing greenhouse gas emissions, and at the same time secure world energy supplies.

As regards renewable energy sources, the development and testing of offshore wind turbines is particularly important. Conflicts of interest tend to arise because of the environmental disturbance caused by wind farms onshore, and this makes it of

interest to move wind power projects offshore, where wind conditions are also better. In the long term, large-scale development of offshore wind farms may have considerable potential globally as one of several measures to increase supplies of renewable energy. In Norway, offshore wind farms can also help to supply petroleum installations with renewable electricity. Two important drivers for a greater Norwegian research effort on offshore wind turbines are the large potential for Norwegian production of renewable energy on the Norwegian continental shelf, and a large international market where Norwegian-based technology may be a winner.

5.1.2 Following up the recommendations of the climate research committee

At the request of the Ministry of the Environment, the Research Council of Norway appointed a climate research committee in 2005 to draw up an action plan for Norwegian climate research. Research institutions, the business sector and the public administration were all represented on the committee, which presented an action plan in August 2006. The action plan gives an overview of current research activity and reviews knowledge needs. It includes the committee's evaluations and recommendations as regards strategic management, meeting knowledge needs, and strengthening competence building and scientific coordination. In drawing up the plan, special emphasis was given to clarifying each ministry's knowledge needs, involvement and responsibilities within climate research. The action plan provides recommendations to the Research Council of Norway and the ministries on scientific and budgetary priorities and on coordination, long-term planning and predictability in climate research. One of the purposes of the plan is to ensure broader involvement of the ministries in this research.

The Government will consider the action plan for climate research in conjunction with steps to follow up the long-term climate targets and the sectoral climate action plans. The Ministry of the Environment will attach importance to the sectoral responsibilities of the various ministries for climate research. In addition to the specific climate research initiative, the broad-based effort to improve recruitment of researchers and upgrade equipment and infrastructure at the universities and colleges will help to strengthen climate-relevant research in Norway.

In 2001, a national technology strategy, OG21, was drawn up for the oil and gas industry in Nor-

Box 5.1 Climate research

The key initiatives in the climate field at present are as follows:

NORKLIMA

The main climate research programme of the Research Council of Norway. The programme is intended to generate new knowledge on the climate system, climate change and the impacts of climate change on the natural environment and society, and knowledge to be used as a basis for adaptation measures by society.

RENERGI

A Research Council of Norway programme called Clean Energy for the Future. It is directed towards research on energy use and energy efficiency, and the structural and technological framework for this. RENERGI also includes research on international climate agreements.

CLIMIT

Public funding for the development of CO₂ capture and storage technologies is channelled through the Natural Gas Power programme, CLIMIT, which is administered jointly by Gassnova and the Research Council of Norway.

Environment 2015

A major environmental research programme starting in 2007. The social science thematic area of Environment 2015 includes research on drivers and conditions for sustainable development, including climate change.

International Polar Year (IPY)

A large scientific programme for the period 2007–2009, intended to generate new knowledge of fundamental processes and key natural phenomena in the polar regions.

Area- and Nature-based Industrial Development (AREAL) and the Wood R&D Programme

These are both Research Council of Norway programmes. AREAL aims to advance area- and nature-based economic development in Norway. The Wood R&D Programme is intended to promote generation of value added through research and development in forestry and wood-based industries. Bioenergy is an important element of both programmes.

Energi21

The Ministry of Petroleum and Energy has taken the initiative for the development of an overall strategy for research and development in the energy sector, modelled on the process in the oil and gas sector (OG21).

OG21

The OG21 Task Force is seeking to reduce CO₂ emissions from the Norwegian continental shelf, and one of the technology target areas in its strategy is environmental technology for the future. OG21 is also working on carbon capture and storage and the use of CO₂ for enhanced oil recovery. OG21 was involved in initiating the Halten CO₂ project, in which Statoil and Shell are evaluating the use of CO₂ for enhanced oil recovery on the Draugen and Heidrun fields.

Education for Sustainable Development

The Education for Sustainable Development plan provides a scientific and educational framework for following up broad-based climate awareness and information campaigns. In cooperation with relevant experts, including the environmental authorities, a web-based tool called the Environmental Education Network (www.miljolare.no) has been developed, which provides guidance on activities dealing with topics such as air and water pollution and energy and resources. Schools can achieve real reductions in energy use by taking part in these activities. The Education for Sustainable Development plan can also be used as a basis for information and campaigns to bring about changes in the behaviour of pupils and their families.

Strategy for joint promotion of mathematics, science and technology

Climate-relevant research is heavily dependent on scientific knowledge. The current strategy for joint promotion of mathematics, science and technology is intended to promote interest in and recruitment to disciplines that are relevant to climate research. As the strategy is implemented, greater weight will be given to the challenges of climate change in order to increase interest in and understanding of these problems among children and young people.

way. Its main aim is to increase value creation on the Norwegian continental shelf and to increase exports of Norwegian oil and gas technology. Eight technology target areas have been established as part of the strategy, one of which is environmental technology for the future. In addition, the Minister of Petroleum and Energy recently initiated a process (Energi21) to establish a broad-based, unified research and development strategy for the energy sector. The purpose of the strategy is to ensure the growth of sustainable economic activity and supply-side security in the energy sector by promoting and coordinating research, development, demonstration and commercialisation of new technology.

The Government will consider whether to establish a forum for strategic cooperation on climate and environmental research modelled on OG21 and Energi21, and will involve actors in climate and environmental research, including research institutions, environmental organisations, public authorities and the private sector, in this cooperation process.

5.1.3 The Research Council's national action plan for climate research

According to the action plan for climate research drawn up by the Research Council of Norway, a total of NOK 1012 million was spent on climate research in Norway in 2005. The main emphasis of Norwegian climate research is on the natural sciences, followed by technological research and social science research. Climate research has been strengthened since the coordinating committee for climate research appointed by the Research Council submitted its report in 2000. The climate research committee appointed in 2005 concludes that the natural science initiative for climate-related research has been successful, and notes that Norway has internationally recognised research communities working on the climate system, climate trends and the impacts of climate change on ecosystems. Moreover, the committee notes that Norway has a leading position in technological climate-related research, especially carbon capture and storage, and that there has been a considerable expansion in energy research in recent years. The committee stresses the importance of linking technological research closely to social science research on prerequisites and instruments for promoting the use of new technology. However, according to the committee, research on the impacts of and adaptation to climate change does

not cover all sectors and aspects of society that will be affected by climate change. In addition, the committee considers social science research to be somewhat fragmentary and split between a number of institutions. This field includes research on national and international climate policy, the framework conditions and opportunities for implementation of technological solutions, vulnerability and adaptation, and the links between social development trends and emissions trends.

The action plan describes the main features of the involvement of various sectors and bodies in Norwegian climate research. The committee considers that several ministries are not sufficiently committed to climate research. This applies both to the provision of funding for climate-related research and to the ministries' understanding and communication of knowledge needs relating to the significance of climate change for their own sectors and the responsibility of these sectors for greenhouse gas emissions. The scope of private-sector involvement in climate research is considered to be too narrow. The committee also points out that there is insufficient high performance computing capacity and important infrastructure for collecting the monitoring data needed for climate research, and that knowledge and dissemination of the results of climate research is too fragmented to contribute constructively to the public debate.

The committee recommends steps to strengthen Norwegian climate research, and points particularly to the need to strengthen, increase involvement in and build up competence in social science research. The committee also identifies a need for Norwegian research in areas where Norway has special national interests that other nations cannot be expected to follow up: for example, Norway as an energy nation, and research needs relating to geographical location, industrial structure and ecosystems in transitional zones. In the committee's opinion, Norway's expertise and financial resources mean that we should take a special global responsibility for research in such fields.

The committee's recommendations include the continuation and strengthening of government-funded research in the following fields:

- Understanding of the climate system and climate trends: this can reduce uncertainty and improve our ability to predict future climate change.
- Technological opportunities for reducing greenhouse gas emissions: will involve continuing the focus on carbon storage and renew-

Box 5.2 Limiting CO₂ emissions from activities in Svalbard

In 2006, the University Centre in Svalbard, with the support of experts in the SINTEF Group and the Norwegian University of Science and Technology, started a local initiative to make Svalbard «CO₂-free» by 2025. A report on this initiative describes a number of measures there are plans to phase in. They include the use of biodiesel in electricity production and in vehicles in Svalbard. In addition, the possibility of carbon capture and storage at the coal-fired power plant in Longyearbyen will be considered.

Although Svalbard accounts for only a modest proportion of Norway's total greenhouse gas emissions, the ambitious environmental targets that have been set for the archipelago imply that activities and settlements, both Norway's and those of other parties to the Svalbard Treaty, should be based on solutions that have as little impact as possible on the climate and the environment. This is also in accordance with the principles underlying the Svalbard Environmental Protection Act.

The Government will continue its efforts to make the Svalbard community more climate-friendly. The goal will be to identify and implement cost-effective measures to achieve substantial cuts in greenhouse gas emissions from activities in Svalbard.

The Government will encourage the choice of climate-friendly solutions, for example through the framework it sets for electricity production and other activities in Svalbard. This framework and requirements that are laid down will be designed to ensure that future energy supplies are based on solutions and technology that minimise greenhouse gas emissions.

However, in Svalbard as in other areas, the costs of climate measures must be in reasonable proportion to the reductions in emissions that can be achieved.

Carbon capture and storage is a very costly process. Efforts in this area must therefore focus on measures and projects that will provide considerable benefits in the form of emission reductions and technological advances. The Government will concentrate efforts in this area on the combined heat and power plant at Mongstad and Naturkraft's gas-fired power plant at Kårstø, and on the CLIMIT research programme administered by Gassnova. Government funding towards the development and establishment of carbon capture and storage cannot therefore be expected if a new coal-fired power plant is constructed in Longyearbyen.

able energy and energy efficiency, and openings for other research on climate-related technology.

- Understanding of the social constraints on and instruments for introducing technology; the implementation of climate policy at national and international level.
- Knowledge about the ecological impacts of climate change, focusing on understanding of processes and systems: this is also a basis for understanding the impacts of climate change on industries based on natural resources.
- Social consequences of climate change, vulnerability and adaptation to climate change.
- Climate change and its impacts in the Arctic and the Barents Sea, where there is a particular need for knowledge.

The climate research committee emphasises that there is a special need to ensure the continuation of

long time series, which is something that requires predictable long-term funding. The committee recommends a substantial increase in the funding provided by the ministries. In the committee's view, several ministries are showing less commitment to climate research than they should, given the committee's interpretation of their sectoral responsibilities in this field. Moreover, the committee considers it necessary to improve interministerial coordination of climate research, and recommends the establishment of a permanent arrangement, headed by the Ministry of Education and Research.

According to the committee, climate research is underfunded. The existing research programmes are not fully financed according to the funding needs set out in their programme plans. In addition, the budgetary framework needs to be expanded to address knowledge gaps that have been identified and to allow for new proposed research initiatives.

5.1.4 Climate research in Norwegian development cooperation

Norway's extensive research results and experience of climate research in the Arctic put the country in a special position and open the way for an expansion of the research dimension of Norwegian development cooperation. Knowledge of the impacts of climate change in the Arctic, obtained for example through the 2004 Arctic Climate Impact Assessment (ACIA), is also widely applicable to other regions that are vulnerable to climate change. As an element of Norwegian development cooperation and of Norwegian climate research at international level, the Government is providing support for two cooperation projects that are using methodology, results and experience from ACIA. These projects are investigating the impacts of climate change on the Himalaya region and on small island developing states. They are international cooperation projects, involving participation by a number of states in the regions concerned.

International cooperation on climate research is also a very important element of the Government's efforts to achieve emission reductions in the major developing country emitters. Climate research cooperation is therefore being included in cooperation agreements that are being drawn up or have already been concluded with countries such as China, India, Indonesia, Brazil and South Africa. Cooperation on the development of alternative energy sources, energy efficiency and carbon capture and storage is of particular interest in this connection.

Like the developed countries, developing countries need to develop knowledge, expertise and capacity in all disciplines, and through both basic and applied research. They need this to be able to make use of knowledge and technology developed by others and adapt them to local conditions. Developing countries are among those most severely affected by climate change, and they have the most limited resources for analysing and mitigating the problems. It is therefore important to give higher priority to research assistance, building up research expertise, building up research institutions and research infrastructure, and research cooperation in development cooperation.

5.2 Climate-related monitoring

The Climate Change Convention sets out obligations for the developed countries relating to research and monitoring. The Conference of the

Parties in Nairobi in 2006 urged developed countries to expand the scope of climate-related monitoring.

The Government's aim is for Norway to be at the forefront of international efforts to develop knowledge in and about the High North, as set out in its High North Policy. Norway's programme for its chairmanship of the Arctic Council also emphasises the need to strengthen climate-related research and monitoring. The temperature is rising about twice as fast in the Arctic as in the rest of the world. Heat transport into the Arctic Ocean takes place through the Norwegian part of the Arctic. Norway therefore has a special responsibility for monitoring climate processes and their impacts on the environment, people and society in the Arctic. By intensifying research and monitoring in the High North, we can gain a unique insight into the ongoing process of climate change, and the positive feedback effects climate processes in this region have on global warming and the impacts on nature and society.

Norway has well-developed research infrastructure and internationally leading centres of excellence in polar research. Norway has also taken a leading role in research linked with the International Polar Year 2007–2008. However, there have been significant cuts in allocations to certain monitoring programmes in the last few years. Strengthening climate-related monitoring will be of great strategic importance in further efforts to strengthen international agreements. At present, climate-related monitoring programmes in the High North are fragmentary, and there are very few long time series for climate and climate-related measurements in the Arctic. Climate monitoring programmes should cover both the atmosphere and the oceans. It is particularly important to monitor the ocean climate, because the greatest impact of climate change is on the distribution of sea ice. Closer monitoring of ocean circulation, fresh water and sea ice distribution, for example in the Fram Strait, will provide a basis for earlier warnings of change. Furthermore, monitoring of the ozone layer in the High North is important because climate change also increases the probability of an «ozone hole» above the polar regions. Ozone measurements in Svalbard were discontinued in 2003 as a result of cuts in funding.

Climate change will affect most sectors of society and most forms of economic activity, and will be particularly important for developments in the High North. Ensuring that there is an integrated, long-term monitoring system is therefore a concern for several sectors.

6 Sectoral climate action plans

6.1 Sectoral climate action plans

The Government proposes climate action plans and sectoral targets for the main sectors responsible for greenhouse gas emissions in Norway. Action plans have been drawn up for the following sectors: petroleum and energy, transport, the manufacturing industries, primary industries and waste management, the municipalities, and functions in the state sector.

The main purpose of the action plans is to identify measures that will result in cost-effective emission reductions that are not currently being implemented in the sector concerned. This is also the starting point for the targets set out for each sector. The sectoral targets are based on estimates, and will have to be reviewed in response to any changes in projections, costs, technological advances and other relevant factors. The current estimate for the technical emission reduction potential for each sector is presented, together with measures the Government intends to initiate.

The Ministry of the Environment commissioned the Norwegian Pollution Control Authority to analyse mitigation options for the period up to 2020. This mitigation analysis is further discussed in Chapter 3.5. The analysis focuses mainly on technical measures, and does not to any great extent include options involving major social change, changes in production levels, or changes in behaviour. The Government will in particular consider measures that will be cost effective with a projected rise in carbon prices over the lifetime of the investment, and that will not necessarily be implemented in response to current policy instruments. In this connection, priority will be given to measures that promote technological developments. Measures may also be considered to encourage the population as a whole to begin a changeover to a low-emission consumption pattern sooner than they would as a result of the projected rise in carbon prices alone.

The Government's proposals for sectoral measures and targets are briefly described below. Further details and a description of climate measures for the state sector are only available in Norwegian.

6.2 Petroleum and energy

The petroleum sector

In its mitigation analysis, the Norwegian Pollution Control Authority estimated the technical emission reduction potential for the petroleum sector in 2020 at 4.6 million tonnes CO₂ equivalents. The CO₂ tax and the emissions trading scheme are the most important policy instruments in the petroleum sector at present. In addition, the authorities have made use of the Petroleum Act to limit emissions by introducing a general prohibition against flaring. The Government will seek continued progress in maximising resource recovery on the Norwegian continental shelf, among other things through an increased recovery rate, additional developments and new projects. The Government will continue efforts towards the electrification of the Norwegian continental shelf by means of technological advances and the use of general policy instruments.

In addition, the Government proposes the following measures:

- Intensifying efforts to develop emission-free energy systems, including research on offshore wind energy. On the basis of technical, financial and supply considerations, electricity generated onshore or emission-free electricity is to be considered for new developments and major development projects.
- The Norwegian Petroleum Directorate, the Norwegian Water Resources and Energy Directorate and the Norwegian Pollution Control Authority will produce an updated analysis of electricity generated onshore/emission-free electricity for the petroleum industry by 31 December 2007.

The energy sector

In its mitigation analysis, the Norwegian Pollution Control Authority estimated the technical emission reduction potential for the energy sector in 2020 at 3.2 million tonnes CO₂ equivalents. The CO₂ tax, the emissions trading system and Enova SF are the most important policy instruments in the energy

sector at present. In addition, the Planning and Building Act can be used. The Government assumes that part of the reduction potential will be released by means of these instruments.

In addition, the Government proposes the following measures:

- Increasing the capital of the fund for sustainable gas technologies.
- Increasing the capital of the fund for the promotion of renewable energy and energy efficiency measures by up to NOK 10 billion by 2012.
- Establishing a demonstration programme for the development and introduction of new renewable energy technologies offshore: this will include developing and testing new technologies for offshore wind turbines.
- Establishing a new support scheme under Enova for the conversion of oil-fired boilers to run on renewable fuels. In addition, the introduction of a prohibition against replacing old oil-fired boilers with new ones of the same type in existing buildings is being considered.
- Prohibiting the installation of oil-fired boilers in new buildings under the Planning and Building Act. The prohibition will be effective from 1 January 2009. There will be room for the necessary exemptions, for example to ensure that energy supplies to important institutions are maintained.
- Continuing efforts to ensure that heating systems are not converted from oil to electricity when oil-fired boilers are replaced in existing buildings.
- Reviewing the tax system with a view to changes that will encourage environmentally friendly behaviour. This is to be done within a revenue-neutral framework. The Government will maintain the same overall tax level as in 2004, and raised environmental and climate-related taxes will be offset by reductions in other taxes.
- Ensuring targeted and coordinated use of policy instruments to expand the production of bioenergy by up to 14 TWh by 2020.
- In addition, the Government will consider:
- Further expansion of measures to promote new renewable energy and greater use of bioenergy.
- Further efforts to bring about a shift in energy production and use and the introduction of natural gas, and assessing whether the position of the most environmentally sound forms of energy can be strengthened so that they are not outcompeted.

- Altering the arrangements for interruptible transmission so that they no longer enable electricity to outcompete new renewable energy in the heating market.

Target

The Government's target is that existing and new policy instruments in the petroleum and energy sector should result in a reduction in greenhouse gas emissions from this sector of three to four million tonnes CO₂ equivalents relative to the reference scenario used as a basis for the Norwegian Pollution Control Authority's mitigation analysis.

The targets for each sector are based on estimates, and will have to be reviewed in response to any changes in projections, costs, technological advances and other relevant factors. If trends indicate that the targets will not be achieved, the Government will consider further measures.

6.3 Transport

Land transport and air traffic

In its mitigation analysis, the Norwegian Pollution Control Authority estimated the technical emission reduction potential for the land transport and air traffic sector in 2020 at 4.4 million tonnes CO₂ equivalents. The CO₂ tax, vehicle taxes, grants for public transport and footpaths and cycle paths, and land-use policy are the most important policy instruments in the land transport and air traffic sector at present. The Government assumes that part of the reduction potential will be released by means of these instruments.

In addition, the Government proposes the following measures:

- Strengthening incentives for urban areas to improve public transport and curb the growth in passenger car traffic (known as the *belønningsordning*), and giving priority to urban areas that wish to test road pricing, variable toll rates or other measures to reduce traffic.
- Continuing efforts to reduce congestion problems for public transport and access for cyclists in towns.
- Intensifying efforts to make transport more environmentally friendly. The Government will consider the establishment of a separate body for this purpose (Transnova) and other instruments.
- Continuing efforts to improve rail transport.

- Reviewing whether part or all of the transport sector should be included in the emissions trading scheme.
- Reviewing the tax system with a view to changes that will encourage environmentally friendly behaviour. This is to be done within a revenue-neutral framework. The Government will maintain the same overall tax level as in 2004, and raised environmental and climate-related taxes will be offset by reductions in other taxes.
- In cooperation with relevant actors, taking the initiative for a strategy for expanding R&D on second-generation biofuels, including evaluating support schemes for demonstration facilities. The possibility of Nordic and international cooperation will be considered.
- Working towards the inclusion of international air traffic in future climate agreements.
- Working towards taxation of international air traffic, the revenues from such taxation to be used towards funding of the UN.
- Holding a public consultation on proposals to amend the regulations to require biofuels to account for at least 2 % by volume of annual sales of road traffic fuels from 2008, rising to 5 % by volume from 2009. The Government will continue to work towards the goal that biofuels should account for about 7 % by volume of sales from 2010.
- Evaluating wider use of road tolls and road pricing. In autumn 2007, the Government will present a white paper proposing that revenues from road tolls may be used for public transport. This is also discussed in the white paper on the Oslo region, which makes it clear that this is something that will continue to be decided locally.
- Playing a leading role in European efforts to introduce stricter standards for vehicles, including seeking to ensure that new vehicles sold after 2015 can use a substantial proportion of climate-neutral or emission-free fuel.

In addition, the Government will consider:

- Further measures to reduce the environmental impact of the Norwegian vehicle population.
- Seeking to ensure that all local and central government vehicles run on CO₂-free or CO₂-neutral fuel by 2020.
- Giving higher priority to road-related measures that have positive effects on the climate.
- On the basis of the results of the feasibility study that has been started, considering

whether to start a planning process for high-speed trains.

Shipping

In its mitigation analysis, the Norwegian Pollution Control Authority estimated the technical emission reduction potential for the shipping sector in 2020 at 300 000 tonnes CO₂ equivalents. The CO₂ tax is the most important policy instrument in the shipping sector at present. The Government assumes that part of the reduction potential will be released by means of this instrument.

In addition, the Government proposes the following measures:

- Building up infrastructure for the distribution of natural gas, among other things to facilitate the introduction of ferries powered by natural gas.
- Drawing up and presenting an overview of all taxes and fees that apply to maritime transport and comparing them with those that apply to other types of transport, in order to promote a shift in goods transport from road to sea.
- Working to promote the inclusion of international shipping in future international agreements on climate change.

In addition, the Government will consider:

- Drawing up a mitigation analysis dealing with costs and the CO₂ emission reduction potential in the shipping sector, and reviewing the possibility of using alternative energy carriers.
- Promoting and facilitating greater energy efficiency and technological advances in the shipping sector.
- Introducing stricter environmental requirements for central government procurement of shipping services.

Target

The Government's target is that existing and new policy instruments in the transport sector should result in a reduction in greenhouse gas emissions from this sector of 2.5–4 million tonnes CO₂ equivalents relative to the reference scenario used as a basis for the Norwegian Pollution Control Authority's mitigation analysis. The targets for each sector are based on estimates, and will have to be reviewed in response to any changes in projections, costs, technological advances and other relevant factors. If trends indicate that the targets will not be achieved, the Government will consider further measures.

6.4 Manufacturing industries

In its mitigation analysis, the Norwegian Pollution Control Authority estimated the technical emission reduction potential for the manufacturing sector in 2020 at 5.8 million tonnes CO₂ equivalents.

The emissions trading scheme and voluntary agreements that run until 2007 are the most important policy instruments in the manufacturing sector at present. In addition, the Pollution Control Act is applicable. The Government assumes that part of the reduction potential will be released by means of these instruments.

In addition, the Government proposes the following measures:

- Continuing to consider which policy instruments should apply to industries that are not covered by the emissions trading scheme or subject to the carbon tax, including whether to require some or all of these industries to take part in the emissions trading scheme, and/or voluntary agreements. This process will be carried out in a dialogue with the manufacturing sector.
- A new investment fund has been established and will give priority to the environment, energy, tourism, marine and maritime sectors, in line with the Government's policy platform. It will focus particularly on climate and environmental measures in all five areas.

In addition, the Government will consider:

- The technical opportunities for and costs of applying carbon capture and storage to process emissions.

The Government's target is that existing and new policy instruments in the manufacturing sector should result in a reduction in greenhouse gas emissions from this sector of two to four million tonnes CO₂ equivalents relative to the reference scenario used as a basis for the Norwegian Pollution Control Authority's mitigation analysis.

The targets for each sector are based on estimates, and will have to be reviewed in response to any changes in projections, costs, technological advances and other relevant factors. If trends indicate that the targets will not be achieved, the Government will consider further measures.

6.5 Primary industries and waste management

Agriculture

In its mitigation analysis, the Norwegian Pollution Control Authority estimated the technical emission reduction potential for the agricultural sector in 2020 at 1.1 million tonnes CO₂ equivalents. The Government assumes that part of the reduction potential will be released by means of existing instruments such as requirements for fertiliser plans and regulation of the spread and storage of manure.

In addition, the Government proposes the following measures:

- Encouraging tree planting and active use of silviculture to increase forest production, using existing policy instruments as a basis and in such a way that priority is given to measures that contribute both to mitigation of climate change and to conservation of biodiversity and other environmental assets.
- Establishing a development programme for climate measures in the agricultural sector funded through the Agricultural Agreement, including measures to reduce N₂O emissions and to build up knowledge about biogas production.

In addition, the Government will consider:

- Encouraging greater production of biogas.
- Policy instruments to encourage action to reduce N₂O and methane emissions from the agricultural sector.
- Encouraging measures that will result in a continued high annual increment and large net uptake of CO₂ in forests, and increasing support for research and competence-building in fields relating to forestry, forest products, bioenergy and the impacts of climate change on the agricultural sector, including building up knowledge on the protection of existing carbon sinks in forest.

Fisheries

In its mitigation analysis, the Norwegian Pollution Control Authority estimated the technical emission reduction potential for the fisheries sector in 2020 at 50 000 tonnes CO₂ equivalents. The Government assumes that part of the reduction potential will be released by means of current policy instruments.

In addition, the Government proposes the following measures:

- Promoting and facilitating greater energy efficiency and technological advances in the fishing fleet, and reviewing the possibility of switching to alternative energy carriers.
- Encouraging the inclusion of requirements for low CO₂ emissions when new investments are made in the fishing fleet.

Waste management

In its mitigation analysis, the Norwegian Pollution Control Authority estimated the technical emission reduction potential for the waste management sector in 2020 at 0.4 million tonnes CO₂ equivalents.

Requirements relating to waste management, the tax on final waste disposal and producer responsibility schemes are the most important policy instruments in the waste management sector at present. The Government assumes that part of the reduction potential will be released by means of these instruments.

In addition, the Government proposes the following measures:

- Prohibiting landfilling of biodegradable waste from 2009. The landfill tax will continue to apply to waste, including biodegradable waste, that is landfilled. The Norwegian Pollution Control Authority has drawn up a proposal for amendments to the regulations relating to the recovery and treatment of waste, including a prohibition against landfilling of biodegradable waste, and a public consultation will be held on this proposal. The Government will make a final decision on how the prohibition is to be worded after the consultation.
- Increasing methane recovery from existing landfills. This involves installing recovery systems at landfills where organic material has been deposited. The methane can either be flared or used in energy production. In either case, emissions are reduced.

In addition, the Government will consider:

- Measures to increase energy recovery from organic waste, including production of biogas, electricity, biofuels, and construction of infrastructure for using waste for industrial heating and/or district heating of residential buildings.

Target

The Government's target is that existing and new policy instruments in the primary industries and waste management sector should result in a reduction in greenhouse gas emissions from this sector of 1–1.5 million tonnes CO₂ equivalents relative to the reference scenario used as a basis for the Norwegian Pollution Control Authority's mitigation analysis. The targets for each sector are based on estimates, and will have to be reviewed in response to any changes in projections, costs, technological advances and other relevant factors. If trends indicate that the targets will not be achieved, the Government will consider further measures.

6.6 Climate-related efforts at municipal level

The Planning and Building Act is one of the most important policy instruments in the municipal sector at present. The Government assumes that emission reductions will be achieved through use of this instrument in climate-related efforts at municipal level. Many of the instruments that are relevant to the municipal sector are discussed in the sections on specific sectors, including the energy sector and the transport sector.

In addition, the Government proposes the following measure:

- Developing a programme for «Towns of the Future». Norway's largest towns will be invited to join in a cooperative effort to identify measures that can be implemented, what effect they will have on greenhouse gas emissions, the costs for various actors, and how different actors can contribute. The Ministry of the Environment will coordinate this work.

In addition, the Government will consider:

- National policy guidelines for climate-related efforts at municipal level

The Government's aim is for municipal policy instruments to make a greater contribution to reducing greenhouse gas emissions in Norway than they do at present.

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