

A Scientific Basis for Climate Policy

*Executive Summary of the report from
The Scientific Council on Climate Issues*

Executive summary

The Scientific Council on Climate Issues has been commissioned by the Government to provide a scientific assessment as a basis for the work of the Climate Committee, the all-party committee for the review of climate policy. An important part of this task is to provide a basis and recommendations for Swedish climate policy targets at national, EU and international level.

Scientific understanding of climate change and its implications is constantly increasing. The fourth assessment report of the UN's Intergovernmental Panel on Climate Change, IPCC, corroborates previous data in many respects. To a great extent, the Scientific Council on Climate Issues bases its conclusions on the knowledge compiled by the IPCC, but it has also taken into account research published at such a recent date that it could not be considered in the latest IPCC assessment report. Other relevant studies, too, have been used. In addition, the Council has chosen to emphasise findings of relevance to Sweden nationally and to Sweden as an actor both in the EU and at global level.

In the opening chapters, the Council looks at climate change, its reasons and its consequences for ecosystems and society. The Council then makes recommendations concerning Swedish climate policy targets at global, EU and national levels, aimed at averting dangerous impact on the climate. In the concluding chapters, the Council presents a number of possible measures and policy instruments, and outlines the likely costs involved if the goals are to be achieved. Taken as a whole, the document represents a comprehensive basis for policy decisions that consider what needs to be achieved to reduce the risks of climate impact and what is actually achievable, i.e. decisions involving trade-offs between economic benefits and costs.

Climate policy involves risk assessment under uncertainty. We now have enough knowledge about the climate system and how

climate change affects ecosystems and society to take action. A considerable degree of uncertainty remains, however, as regards the climate system and the impact of climate change on ecosystems and society. In other words, there is a danger that the consequences will turn out to be more serious than we are in a position to assess on the basis of present knowledge. This is further reason for taking action.

The Council takes the view that Sweden must take an active part in research and development focusing on the earth's climate system, climate impacts, vulnerability, adaptation, measures and policy instruments. An important element in this should be supporting such research in developing countries.

Below is a presentation of the Council's most important conclusions.

Climate change and its consequences for ecosystems and society (Chapters 2 and 3)

The earth's surface has become warmer and it is very likely that this has been caused by human activity. The Council has examined the data from the IPCC and concurs with the IPCC's overall assessment both of climate change and of its implications for ecosystems and society.

Climate change

The Council observes

- that the global mean temperature has risen by just over 0.7°C over the past 150 years and is currently rising by almost 0.2°C per decade
- that most of the global warming that took place during the latter half of the 20th century was very likely due to an amplified greenhouse effect caused by human emissions of greenhouse gases (GHGs)
- that unless vigorous measures are introduced, the global mean temperature is expected to rise by 1.6–6.9°C by the year 2100, compared with the pre-industrial era, and then to continue rising in the next century

- that the extent of future climate change depends on factors such as population trends and socioeconomic and technological development
- that most changes in the physical climate occur gradually but that rapid and abrupt changes cannot be ruled out. The risk of abrupt change increases as the temperature rises.
- that further changes in temperature, sea levels and precipitation, along with those already observed, will display very significant regional variations.

Consequences for ecosystems and society

The Council observes

- that the consequences for ecosystems and society will become more numerous and extensive the faster and higher temperatures rise. In global terms, the negative consequences will outweigh the positive ones.
- that the consequences will differ very significantly between regions, depending on the extent of regional climate change and on variations both in natural systems and in societies' levels of vulnerability and capacity to adapt. Particularly at risk are the Arctic, parts of Africa and Asia.
- that consequences for ecosystems and societies arise both gradually and abruptly. Climate change has already had observable impacts.
- that the consequences that give particular cause for alarm today are the risk of diminished food production and changes in water supply in certain areas, and biodiversity loss and coastal flooding
- that the consequences of climate change may be reinforced by other global changes taking place simultaneously (such as population density, resource use and environmental degradation). Climate change also makes it more difficult to confront other global challenges, including poverty eradication.
- that adaptation measures are essential and should be integrated into international and national efforts to promote social

development. The prime focus, however, should be on emission reduction.

Climate policy targets (Chapters 4 and 5)

Very considerable restrictions on GHG emissions will be needed if the risk of harmful climate impact is to be reduced. The Council takes the view that targets must be established for global temperature rise, for the global stabilisation of GHG concentrations in the atmosphere, and for the reduction of emissions. The various targets at global level can largely be derived from one another on the basis of the temperature target. The Council bases its recommendations concerning targets on the current state of scientific knowledge. These targets may need to be revised as our understanding of the climate system and society improves.

The Council's conclusions regarding climate policy targets are presented below and are summarised in the table that follows.

Globally: Temperature target, concentration target and emission targets

The Council considers

- that the EU's two-degree target is a reasonable basis for emission-reducing measures, but that the possibility of lower temperature rises having severe impacts cannot be ruled out
- that the two-degree target can likely be achieved if GHG concentration in the atmosphere is stabilised in the long term at 400 ppmv carbon dioxide equivalents (CO₂e). If it is stabilised at 450 ppmv CO₂e there is a significant risk that the two-degree target will not be achieved.¹

¹The concentration of greenhouse gases (GHG concentration) currently stands at approximately 450 ppmv CO₂e and is increasing by just over 2 ppmv per year. The fact that this has not yet led to a temperature rise of more than 0.7 degrees since pre-industrial times is due to the simultaneous release of particles that have a masking effect, and to inertia in the climate system. That concentration levels below the present one are achievable is due to the fact that greenhouse gases can be absorbed or broken down by natural systems.

- that global GHG emissions in 2020 will need to be about 10 per cent lower than the 2004 level if GHG concentration is to be stabilised at 400 ppmv CO₂e in 2150²
- that by 2050 global emissions need to be at least halved compared with the 1990 level (if the target of 400 ppmv CO₂e is to be achieved)
- that by the end of the century global emissions need to have been reduced virtually to zero (if the target of 400 ppmv CO₂e is to be achieved).

The EU and Sweden: Emission targets

The reduction requirements for Sweden and the EU have been calculated using a number of frequently discussed models for how emission reductions are to be differentiated globally, known as differentiation models. The choice among models dealt with in the report does not significantly affect the size of the emission reductions required of Sweden. Other models may yield other outcomes.

The Council considers

- that the EU's GHG emissions compared to the 1990 level should be reduced by 30–40 % by 2020 and by 75–90 % by 2050 if the Union is to take its share of the global responsibility for achievement of the two-degree target
- that Sweden's GHG emissions compared to the 1990 level should be reduced by 20–25 % by 2020 and by 70–85 % by 2050 if Sweden is to take its share of the global responsibility for achievement of the two-degree target
- that a national emission target for Sweden should be formulated as a target with deductible emissions allowances, i.e., that assessment of target achievement is based on the amount of emission allowances allocated or auctioned by Sweden to activities covered by the EU emissions trading scheme rather than the actual volume of emissions from these activities.

² Compared with the 1990 level, this corresponds to an increase in emissions of about 10 per cent.

Table Recommendations on targets for climate policy

TYPE OF TARGET	LEVEL		
<i>Temperature target</i>	<i>Global</i>		
Maximum increase in temperature compared to pre-industrial level	Max 2°C		
<i>Concentration target</i>	<i>Global</i>		
Long-term stabilisation level, GHG concentration in the atmosphere			
Probability of achieving the 2°C target:			
>66 %	400 ppmv CO ₂ e		
approx 50 %	450 ppmv CO ₂ e		
<i>Emission targets</i>	<i>Global</i>	<i>EU</i>	<i>Sweden</i>
Reduction in CO ₂ e emissions in relation to 1990 levels, consistent with a concentration target of 400 ppmv CO ₂ e			
2020	0–incr. 10 %	30–40 %	20–25 %
2050	min. 50 %	75–90 %	70–85 %
2100	almost 100 %	approx. 100 %	approx. 100 %

Source: Swedish Scientific Council on Climate Issues.

Note 1: The reduction requirement given for Sweden is based on estimates of what Sweden needs to do to take its share of global responsibility to achieve the two-degree target. The targets that Sweden should set up depend on political assessments that include temperature target, the application of the precautionary principle and whether Sweden should be a frontrunner.

Note 2: Emissions of GHG in Sweden in 2005 were some 7 per cent lower than the 1990 level.

Note 3: CO₂e means carbon dioxide equivalent and ppmv means parts per million by volume.

Measures for reducing emissions (Chapter 6)

The Council has provided an overview of possible measures for reducing emissions. Emissions can be reduced in all sectors of society. Action needs to be taken to avert future increases in emissions as a result of population rise, increased industrialisation, infrastructural development and economic growth.

The Council considers

- that the global emission reductions deemed necessary to the achievement of the two-degree target may be achieved by applying both technologies currently available in the market and technologies that may be expected to arrive in the market over the next few decades

- that changes in consumption patterns are of crucial importance when seeking to reduce GHG emissions
- that a combination of increased energy efficiency, energy saving and measures in respect of energy supply are required if the climate targets are to be achieved
- that increased energy efficiency and energy saving have high potential for reducing GHG emissions at low costs
- that renewable energy (bioenergy, sun, wind, water), nuclear power and the capture and storage of CO₂ can help reduce emissions. In the case of nuclear power, generally acceptable solutions must be found to the problems of safety and security, waste, the risk of nuclear weapons proliferation and terrorist acts.
- that the efforts made to reduce GHG emissions over the next few decades will largely determine the extent to which achievement of the two-degree target will be possible
- that achievement of a Swedish emission target for the year 2020 should to an overwhelming extent be sought via a combination of domestic measures, especially in the transport sector, and a reduced allocation of emission allowances to sectors covered by the EU emissions trading scheme. Government investment in emission-reducing projects in developing countries, via the Clean Development Mechanism (CDM), may be required as a supplement.

Climate policy costs and benefits (Chapter 7)

Assessments of costs and benefits to society are a crucial part of the climate policy discussion. This refers to costs associated with reducing GHG emissions in sectors such as energy supply, transport, construction, and agriculture and forestry. It also refers to benefits in the form of reduced damage and other benefits that such measures may yield over and above reduced emissions. The delimitation lines drawn when estimating costs and benefits have a decisive impact on the calculations.

The Council considers

- that assessments of the costs of damage caused by climate change are uncertain, to some extent ethically controversial, and strongly dependent on what kind of damage is included, what value is attached to it, and how the future is viewed in terms of value (discounting)
- that there are significant uncertainties in estimates of costs associated with GHG emission reduction
- that the global and national costs of reducing emissions to levels compatible with the two-degree target are significant but compatible with sound macroeconomic development
- that the cost of reducing emissions decreases if cost-effective policy instruments are chosen
- that the cost of reducing emissions decreases if other benefits deriving from greater energy efficiency and renewable energy use are taken into account, such as cleaner air and higher security of energy supply.

Climate policy instruments (Chapter 8)

If the desired measures are to be taken at reasonable cost, both the choice of instruments and the direction of climate policy are crucially important. On the basis of research in environmental economics and other disciplines, the Council has discussed a selection of main issues.

The Council considers

- that the climate issue must be solved through international cooperation
- that policy instruments for reducing GHG emissions should preferably be broad, internationally coordinated, uniform and technologically neutral, but that departures from this principle may sometimes be warranted
- that setting a price on GHG emissions with a view to achieving the climate targets is of fundamental importance

- that the economic instruments of CO₂ tax and emission trading are important and powerful policy instruments if properly designed
- that economic instruments need to be supplemented by other policy instruments such as education, information and legislation
- that Sweden must be proactive in the EU in seeking to improve the EU emission trading scheme. It is important that the emission cap is lowered and auctioning of allowances is applied.
- that new technology is crucial to the task of solving the climate problem. The imperatives in this respect are research and development and policies that create markets for the commercialisation of these technologies.
- that Sweden should work actively at international level to abolish subsidies for extraction and use of fossil fuels.