Abstract. In Germany, acidifying emissions have decreased since the mid-eighties, but are still at levels that cause environmentally harmful acid deposition and thus make further action necessary. The driving force behind such actions is the precautionary principle laid down in pollution control legislation. It is implemented as a requirement to minimize emissions and mandates the parties concerned to formulate and implement emission control requirements based on the state of the art, and to update them as technological advances are made. As the scope for restructuring energy supply and switching to environmentally friendlier sources is very limited in Germany, strategies for controlling inevitable NO\textsubscript{X} and SO\textsubscript{2} emissions will continue to be directed at further improving the technical systems (besides necessary changes in lifestyle). Since the large-scale retrofit programmes were initiated in the eighties, technological advances have provided some scope for a further tightening of emission reduction requirements for SO\textsubscript{2} and NO\textsubscript{X}. In addition, there is some potential for further reducing these emissions through more energy-efficient demand- and supply-side technology.

Key words: acidifying emissions, control technologies, energy efficiency, policy instruments

1. Introduction

The most important air pollutants and sources causing acidification are sulphur dioxides (SO\textsubscript{2}) from combustion plants, ammonia (NH\textsubscript{3}) from agriculture and nitrogen oxides (NO\textsubscript{X}) from motor vehicles and combustion plants. Acidification problems can be dealt with at the various levels at which they arise:

Compensatory measures - including liming and fertilization but also payment of compensation - are usually actions taken as a last resort to avert or offset damage. The applicability of such measures is limited. Environmental quality standards, i.e. maximum-permissible concentrations of pollutants in air and maximum-permissible deposition rates, constitute thresholds derived on the basis of knowledge about the effects of pollutants. Comprehensive concepts for environmental quality standards are, however, difficult to develop because the underlying knowledge about effects is often incomplete and their implementation requires emission and product standards directly aimed at the emission sources, involving complicated dispersion modelling. Nevertheless, effect-based environmental quality standards, as a measure for the carrying capacity of the ecosystem, constitute the right methodological approach because they place the assets to be protected and the carrying capacity of the ecosystem at the heart of the matter.

A point to be noted for the German air pollution control concept is the independent function of emission and product requirements which mainly reflect technical feasibility of avoiding emissions at source. All the measures mentioned are used in Germany to combat acidification problems, although their practical relevance differs greatly.

2. Technology based air pollution control - concept and regulations

When the subject of acidification with its catchwords "acid rain" and "forest die-off" was taken up by policymakers in the late 1970s, effective measures could be initiated relatively quickly, as there was knowledge about both the causes and sources as well as about remediation technologies (Schärer et al., 1980). What was also of crucial importance, however, was that the regulatory framework for combating acidification processes and damage to forests did not have to be created but was already in place. The basis for the measures was the principle of "precautionary action", which was incorporated in the Federal Immission Control Act (Bundes-Immissionsschutzgesetz - BImSchG) as early as 1974 and requires technology-based emission control requirements to be formulated for all sources of air pollution. It mandates decision-makers to take actions which go beyond an averting of concrete environmental hazards and do not necessarily require scientific evidence of the existence of such hazards as a prerequisite. Rather, measures are to be taken in an anticipatory manner, so as to avoid and reduce environmental risks. Consequently, in Germany, technological development is a main driving force behind decisions taken in environmental policy and behind actions taken to enforce legislation regulating high-emission-volume air pollutants.

For the purposes of air pollution control, this abstract imperative is implemented by requiring all relevant emission sources to minimize emissions on the basis of the state of the art. State of the art is taken to mean in this context the state of development of advanced processes, of facilities or of modes of operation which is deemed to indicate the practical suitability of a particular technique for restricting emission levels. Within the framework of the treaty on the unification of the two German states it was agreed that the requirements existing in the original (western) Federal Republic should be applied identically in the new federal states (former GDR). Especially power plants and industrial plants should comply with the same emission standards within a certain timeframe, but by the year 1999 at the latest (Bundesumweltministerium, 1992).

The single most important regulation for the control of acidifying emissions is the Ordinance on Large Combustion Plants of 1983, which consistently translates the technology-based air pollution control concept into emission control requirements. Applying to all combustion plants with a thermal rating of 50 MW and more, it lays down emission control requirements, provisions concerning the release of flue gas, emission measurement and monitoring, as well as a binding timeframe within which existing plants have to be retrofitted or shut down. As of 1 April 1993 at the latest, all existing plants had to comply with the same emission limits as new plants. A comprehensive overview of technologies to clean up power plants is provided by Schärer, 1993. In the new federal states, the deadline for the retrofitting of major power plants is 1 June 1996.

Next followed, in 1986, the amendment to the Technical Instructions on Air Quality Control (TA Luft). The tightened TA Luft emission requirements for sulphur and nitrogen compounds covered all other combustion plants and industrial processes subject to licensing. In the original federal states, these were to be retrofitted or shut down by 1994 according to a graded time schedule oriented towards the quantity and noxiousness of the emissions. The time periods applicable in the new federal states will run out