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Reclip:tom: Research on Climate Protection

Technical Options on Emission Mitigation

The project reclip:tom sets up sector comprehensive emission prognoses up to the year 2050. Mitigation measures and their costs are proposed. Interactions within a sector and between the sectors are especially taken into consideration. This paper discusses the procedure for the agricultural sector and its interactions.

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Keywords

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In 2005 a 3-year research project (Reclip:tom) was initiated to suggest options for mitigation of Austria's national greenhouse gas emissions, and for the quantification of their potential and costs. Reclip:tom is carried out as a close cooperation between two Austrian universities and Austrian Research Centers Ltd. Reclip:tom projections will be based on a "business-as-usual" scenario and the further development of emissions up to the years 2008 to 2012 (Kyoto period), 2020 and 2050 will be estimated according to "current legislation" using available and officially accorded activity projections and extrapolations [1]. As these projections aim for consistency with official Austrian policy, also recommended measures for emission mitigation will do so.

Options for greenhouse gas mitigation are partially available for Austria. A systematic evaluation of these options that is consistent through all emission sources and sectors is currently lacking. Such an evaluation is crucial for a cost effective compilation of mitigation measures. Reclip:tom not only considers single measures, but defines packages of measures and incorporates mutual dependencies.

Information gained from the defined packages of measures will be compared to international data bases. The focus will be on the comparison of reclip:tom results with GAINS data [2, 3]. GAINS is based on the IIASA-RAINS model [4] and includes – in addition to the RAINS data – greenhouse gases.

As a result, a range of measures or packages of measures will be made comparable based on their costs. A cost curve will be developed and mitigation costs will be compared to emission trading costs.

For reclip:tom, Austria's national GHG emissions have been broken down into four sectors: energy, industrial processes, agriculture and soils. These are being dealt with within individual work packages, with the respective sector experts in charge. The identification and quantification of interactions between emission sectors is given high priority in reclip:tom.

Approach

Each sector of assesses the following data for Austria:

- current emissions and emissions trends according to current knowledge
- mitigation options
- mitigation potential
- mitigation costs
- side effects (positive and negative) on other greenhouse gases and environmental parameters
- external influences on the proposed measures

Reclip:tom estimates greenhouse gas emissions for the year 2000 based on the emission inventory that is published by the Austrian Environmental Agency [5]. Entities and measures are defined for each of the four sectors: energy, industrial processes, agriculture, and soils. Entities can be unambiguously described through statistic data: e.g. energy flow, mass flow, animal numbers. So far, about 90 different entities have been defined within the four sectors of reclip:tom [6]. The quantity of the data that are to be grouped according to the defined entities will be estimated for the base year (2000) and for two years in the future: 2020 and 2050. The baseline projection to the years 2020 and 2050 will be based on an extrapolation of the business-as-usual scenario. Several mitigation options and their costs may be assigned to each entity. After the introduction of mitigation options, greenhouse gas projections for the years 2020 and 2050 will again be estimated and compared to the business-as-usual scenario.

Agricultural sector of reclip:tom

Emission estimates

The "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories" [7] require emissions from the following categories to be quantified: CH_4 emissions from enteric fermentation, CH_4 and N_2O emissions from manure management, direct N_2O emissions from agricultural soils, and indirect N_2O emissions from N use in agricul-

ture. The Austrian emission inventory estimates GHG emissions according to the IPCC reporting guidelines [7] taking Austrian specific data into consideration, rather than default values, where possible [8, 5]. The following animal categories are included: "cattle" (dairy cows > 2 years, mother and suckling cows > 2 years, young cattle < 1 year, young cattle 1 - 2 years, other cattle > 2 years), "swine" (fattening pigs > 50 kg, swine for breeding > 50 kg, young pigs < 50 kg), "sheep and goats", and "poultry" (chicken, other poultry). Reclip:tom proposes mitigation measures for each of these categories.

Mitigation options

A range of potential mitigation options has been proposed, and fed into reclip:tom. This section briefly summarises the most important mitigation options identified.

CH_4 emissions from enteric fermentation

CH_4 emissions from enteric fermentation of dairy cattle may be reduced through an increase in milk production per cow. This is achieved via more concentrate and less roughage feeding. Especially in Alpine regions, the cows´ diet is mainly based on locally grown grass. Concentrates are mostly imported. Ecological side effects of an increase in concentrate feeding must be considered. The optimum milk yield may lie in a range that can mainly be achieved from feeding roughage and that does not decrease the lifetime milk yield of the cows.

CH_4 emissions from manure management

CH_4 emissions from manure management may be reduced through manure treatment: either biogas production or separation of solids. Biogas production is mainly implemented for energy production reasons, but at the same time reduces CH_4 emissions during manure storage. Through slurry separation, organic carbon is mechanically separated. The remaining liquid fraction has a lower carbon content and thus a lower potential for CH_4 losses [9].

With solid systems the aerobic composting of farmyard manure is a possible way to reduce CH_4 emissions.

N_2O emissions from manure management

N_2O emissions from manure management are strongly dependent on the manure N content. The lower the manure N content, the lower the N_2O emissions. Manure N content is related to the N content in the diet. N surplus should already be avoided in the animal diet. Matching of the N input in the diet with the animal's requirements is a very promising option to reduce N excretion. With pigs, this means the introduction of phase feeding.

An increase in the percentage of grazing leads to a reduction in N_2O emissions from manure management.

Direct N_2O emissions from agricultural soils

Direct N_2O emissions from agricultural soils can be reduced through less mineral fertiliser application. N input must meet the crop's demand. As with N_2O emissions from manure management, the matching of the N-content of the diet to the animal`s requirements reduces N excretion and consequently also direct N2O emissions from agricultural soils.

Indirect N_2O emissions

Indirect N_2O emissions can only be reduced if the agricultural N surplus is reduced. It must be an aim to close the N cycle, to improve N usage and to reduce N surpluses.

Emission projections

Emission projections in the agricultural sector will to a great extent depend on the development of the number of animals. For Austria, emission projections until the year 2020 have been set up within the CAFE programme (Clean Air for Europe[1]) of the EU. In Austria, a working group in collaboration with IIASA has projected animal numbers and emissions until the year 2020. They concluded the following general trends: A reduction in dairy cow numbers, a slight reduction in calf numbers, a slight increase in suckling cows, a slight increase in pig numbers, and no or little changes in sheep and goat numbers.

Outlook

Emissions sources and processes were identified and mitigation measures proposed. Possible side effects and interactions were also identified. In a next step, costs and mitigation potentials will be worked out. Extrapolation scenarios for the years 2010, 2020 and 2050 will be produced. The project will last until December 2007.

[1] Directive of the European Parliament and of the Council on Ambient Air Quality and Cleaner Air for Europe
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