Cost curves for ammonia mitigation measures in German livestock systems

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Abstract

The research work reported here is aiming at a consinstent cost calculation model for livestock farming in Germany, which can be used for the exante and expost calcuation of ammonia mitigation costs. By analyzing existing investment datasets for livestock buildings of the past two decades and own surveys ammonia a data reprocessing procedure shall provide ammonia mitigation cost curves for various animal categories.
Application of the model results in ammonia mitigation costs for German finishing pig stock between €5.9 and €10.5 million for covering manure storages with plastic foil, between €10.4 and €30.3 million for tent roofs and between €10.2 and €17.4 million for concrete covers

Keywords: Agriculture; livestock; IED directive; Germany; ammonia emission mitigation costs; cost curves

1. Introduction

The research work reported here is aiming at a consinstent cost calculation model for livestock farming in Germany, which can be used for the exante and expost calcuation of ammonia mitigation costs. By analyzing existing investment datasets for livestock buildings of the past two decades and own surveys ammonia a data reprocessing procedure shall provide ammonia mitigation cost curves for various animal categories.

2. Methods

The basis for the development of an up-to-date cost model for farm buildings is the BMEL/KTBL data system „BAUKOST“. However, these data basis is not up to date. The surveys for construction investment and costs date back to the beginning of the current millennium until to 2014. Based on these data sets, extensive and further research was conducted to verify, expand and precise these data sets; these include, in addition to other sources, data sets from ALB Hessen, LfL Bayern, and own surveys. Research was conducted only for conventional livestock systems.

A total of about 250 data sets have been evaluated for the animal categories (100 cattle, 80 swine, 70 poultry), which, as expected, are not consistent in both structure and timeliness.

Based on these data, a data system was developed, which is characterized by the following components:

Data system for cattle, pigs and poultry with medium to high numbers of animal places, as well as above and below the integrated permit levels. The data system is created with investment ratios and cost blocks according to DIN 276.

For the calculation of the annual construction costs, the cost blocks are subdivided into three useful life categories in accordance with the BAUKOST system.

The dilemma about the very different survey periods and thus by the majority not comparable construction costs is solved by a scaling algorithm, so that according to the survey periods an adjustment of the investment and costs with construction cost indices as well as the livestock numbers can be made.

The calculation of the construction costs corresponds approximately to the building utilization costs according to DIN 18960. They are determined from capital allowances, interest costs, repair costs, insurance costs and other costs. The determined construction costs are incorporated into a benefit-cost calculation, which is used to determine the

process costs and the unit costs for the production of animal products.

By defining a reference process, it further allows to determine the extra costs for production processes to be compared, thus also calculating emission mitigation costs. For this purpose, surveys were conducted among manufacturers of abatement technologies.

Since construction costs are subject to size degression, housing systems with different numbers of animal species were selected and analyzed, covering the typical size range of large, medium and small livestock enterprises.

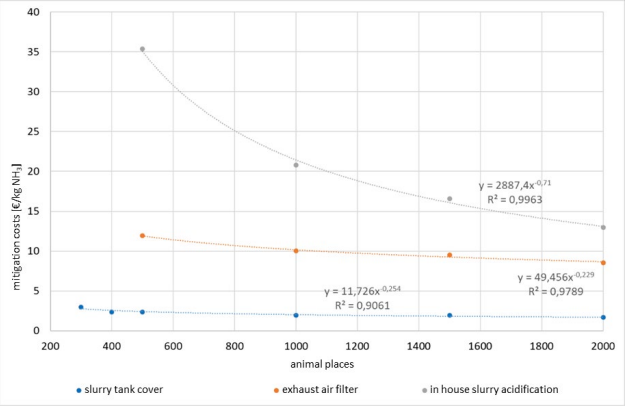
With the data and calculation system, which is designed for time- and size-dependent scalability of construction and manufacturing costs, differentiated emission reduction costs can be calculated. In the future, these methods will offer the option to be used for the calculation of national compliance costs as well as for the determination of their time series.

3. Results

The calculation system was used to calculate size- and technology-dependent cost functions that can be used for a variety of purposes. They can be used to calculate national reduction scenarios, such as those created in the national clean air plan, or in regional scenarios for reducing emissions at the district or municipal level.

By intersecting the process costs of different abatement measures and the abatement effect of these measures, the NH_3 abatement costs can be determined. Due to the farm size dependent cost degression for measures, a farm size dependent degression of the NH_3 abatement costs results (illustrated by the example of the slurry storage cover, s. figure 1). The abatement costs and the abatement effect can be used to calculate the national compliance costs of the mitigation measures.

Figure 1: NH_3 emission mitigation costs curves for measures in the house and covering slurry storage tanks as a function of the number of animal places in fattening pig barns



Without taking into account the size distribution of the farms and under the hypothetical assumption that all fattening pigs are kept in farms of the same size, these costs for Germany as a whole are between €5.9 and €10.5 million for covering manure storages for fattening pigs with plastic foil compared with the reference (manure storage without storage cover), between €10.4 and €30.3 million for tent roofs and between €10.2 and €17.4 million for concrete covers.

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