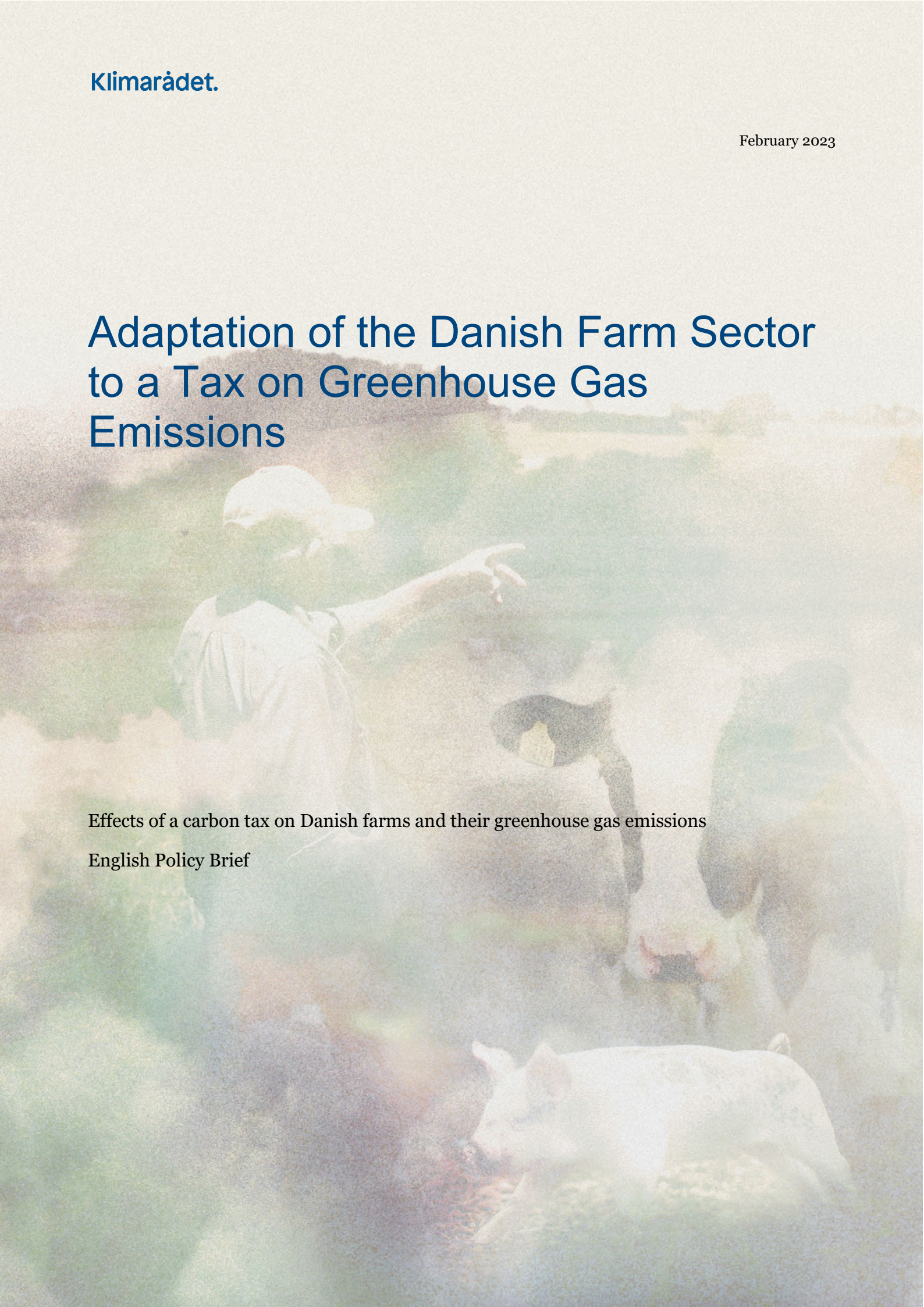


Adaptation of the Danish Farm Sector to a Tax on Greenhouse Gas Emissions

Effects of a carbon tax on Danish farms and their greenhouse gas emissions

English Policy Brief



Adaptation of the Danish Farm Sector to a Tax on Greenhouse Gas Emissions - a Policy Brief

Abstract

This analysis investigates how a carbon tax of DKK 750 per tonne CO₂e may contribute to the transition of the Danish agricultural sector towards more climate friendly activities. The analysis is based on farm-level financial data and calculations of greenhouse gas emissions for about 1,400 Danish farms. The analysis shows that a tax of DKK 750 per tonne of CO₂e reduces 2030 emissions by around 45 percent compared to 1990 levels when only existing technical abatement measures are considered. Around half of the reductions are expected to be achieved by negative emissions through increased carbon sequestration and storage. The emissions reduction of 45 percent compared to 1990 levels is, however, not sufficient to meet the sector's 2030 target of 55-65 percent emissions reductions. The analysis demonstrates that, after the introduction of a carbon tax, the number of farms with negative net income increases from around 25 percent to 45 percent of all Danish farms. Especially, cattle farms are affected by the tax. Increasing the tax level to DKK 1,500 per tonne CO₂e will not lead to a significant increase in the implementation of technical abatement measures, since there are few cost-attractive options available. These results indicate that existing technical abatement measures will not be sufficient to meet the sector's 2030 target, and structural changes and innovation will be necessary for the sector's long-term transition. A higher carbon tax will accelerate these structural changes and innovation. Supplementary policies such as subsidies can be introduced to mitigate the negative effects on farm income. Such policies, however, risk lowering the incentive to mitigate emissions or creating lock-in effects.

This is an abbreviated translated version

This report is an abbreviated version of the original Danish report. The original report was published in February 2023.

This translated version aims to bring the conclusions of the Danish Council on Climate Change (DCCC) to a broader audience. However, this is a summary of the original report. If you find that some information is missing, or you would like to learn more about the conclusions, assumptions or methodology, please reach out to the secretariat of the DCCC. We would be pleased to help. You can reach the secretariat at mail@klimaraadet.dk.

Introduction

The agricultural sector is a major contributor to greenhouse gas emissions in Denmark. According to projections from the Danish Energy Agency, agricultural emissions will account for 40 percent of total Danish greenhouse gas emissions in 2030, with current policy. On this background, the Danish government has announced plans for a tax on agricultural greenhouse gas emissions, but the specific implementation of these plans is still to be decided upon.

Denmark is among the most intensively cultivated countries in Europe. Agricultural land currently covers around 60 percent of the Danish land area. The majority of agricultural emissions originates from the cultivation of land

and the production of livestock. Although agricultural emissions are decreasing, they are expected to constitute an increasing share of Denmark's total emissions, as illustrated in figure 1.1. This is due to other sectors reducing their emissions even more and at a faster pace than the agricultural sector. Thus, great reductions in agricultural emissions are required to reach the Danish climate target of a 70 percent emissions reduction by 2030 compared to the 1990 level and to reach the long-term goal of climate neutrality by 2050.

The current analysis investigates how a carbon tax of 750 DKK per tonne CO₂e may contribute to the transition of the Danish agricultural sector towards more climate friendly activities. This analysis involves mapping the opportunities for reducing greenhouse gas emissions through known technical abatement measures including changes in land use on the existing farm unit. Based on this, we demonstrate the effects of a carbon tax on both farm income and sectoral greenhouse gas emissions. Lastly, we discuss various policy measures for mitigating the economic impact on the agricultural sector and point to possible dilemmas related to implementing cost-effective policies.

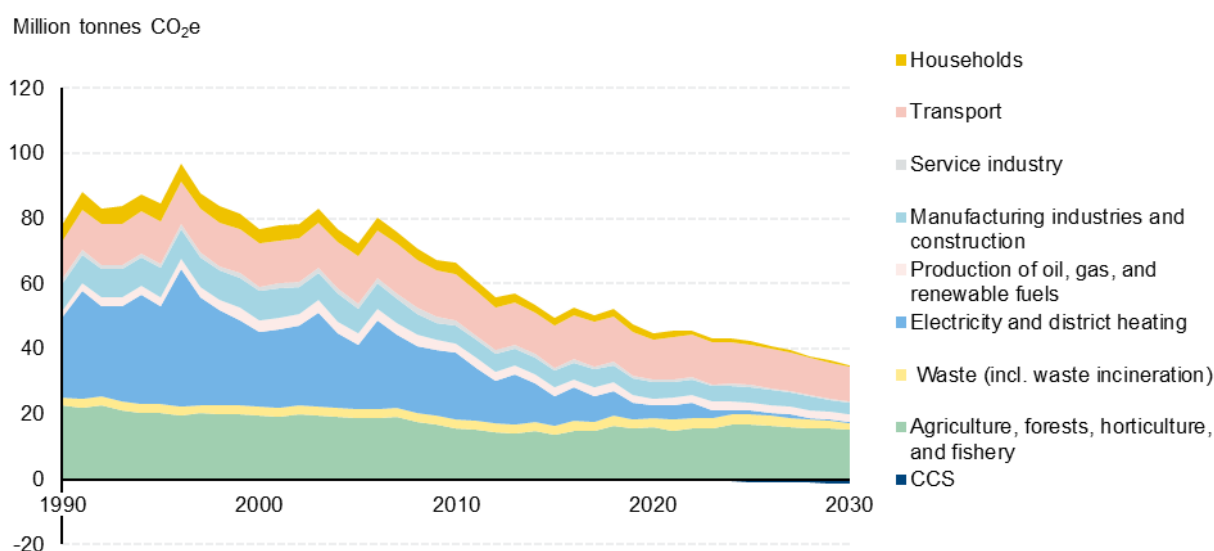


Figure 1.1 Denmark's greenhouse gas emissions 1990-2030 by sector

Note 1: This figure shows historical emissions until 2020. Emissions after 2020 are based on Denmark's Climate Status and Outlook 2022 from the Danish Energy Agency.

Source: Danish Energy Agency, Denmark's Climate Status and Outlook 2022, 2022.

Approach

We carried out a short-term bottom-up analysis based on farm financial data from the year 2020 for approximately 1,400 Danish farms. The data for the analysis were provided by Statistics Denmark. The data give a comprehensive description of each farm's activities and the farm's financial costs and outcomes. These data were combined with data on greenhouse gas emissions from each farm calculated by the consultancy ConTerra. The analysis thus provides a detailed description of variability in financial outcomes and emissions from single farms and between types of farms (pig, cattle and crop production). Based on farm type, opportunities for mitigating emissions for every farm are identified. The analysis presents the marginal abatement cost curve, which is based on farmers' cost-minimising choice of technical abatement measures when exposed to a carbon tax. The main scenario in the analysis analyses a carbon tax of DKK 750 per tonne CO₂e. The tax level corresponds to the tax level agreed on in the Danish Parliament in 2022 for the majority of the sectors that are not part of the EU's Emissions Trading Scheme.

Main findings

Based on the analysis of a tax on agricultural greenhouse gas emissions, the DCCC highlights the following conclusions:

Implications for the 2030 climate target

The analysis shows that a carbon tax of DKK 750 per tonne of CO₂e reduces emissions by around 45 percent compared to 1990 levels when only existing technical abatement measures are considered. Negative emissions through increased carbon sequestration and storage are expected to account for around half of these reductions. The analysis did not allow for structural changes in production systems (structural changes), such as converting cattle farms to less carbon-intensive production systems.

However, technical abatement measures are not sufficient to meet the 55-65 percent emissions reduction target for the agriculture and forestry sector in 2030 as compared with 1990. Consequently, the DCCC finds that a combination of new and emerging technologies as well as changes in production systems (i.e., structural changes) will be required before 2030.

The DCCC expects a tax of DKK 750 per tonne of CO₂e will encourage additional structural changes in agriculture and accelerate innovation and implementation of new low-carbon technologies and farming practices. This implies that the carbon tax might ensure that the expected reductions can be achieved in 2030.

Increasing the tax to DKK 1,500 per tonne of CO₂e will not lead to a significant increase in the implementation of technical abatement measures. This is due to a number of challenges with current, well-known technical abatement measures; There are only a few of them, they have limited emissions reduction potential, and a number of them are expensive to use. Further, the possibility of implementing the measures is limited for some farmers due to the EU harmonisation requirements and the need for production of roughage.

A carbon tax must provide long-term incentives for climate change mitigation

The analysis shows that a narrow focus on technical abatement measures risks slowing down the long-term green transition. Large investments in biogas plants, for example, may cause dependency on carbon-intensive farming practices and prevent structural changes in the longer run. As a consequence, the agricultural sector risks locking-in greenhouse-gas-intensive technologies and farm practices.

Structural changes are required to reach Denmark's long-term goal of climate neutrality by no later than 2050. Such changes may include a transition from cattle farming towards less carbon-intensive production systems. Without structural changes, the agricultural sector is not expected to become climate neutral by 2050, even if the sector's emissions are reduced by at least 55 percent by 2030. The need for structural changes will be even more acute if the 2050 target is brought forward to 2045, as recently proposed by the Danish government.

Implications of a carbon tax on agricultural greenhouse gas emissions

A tax of DKK 750 per tonne of CO₂e will increase the number of farms with negative net income before owner remuneration and after financial costs. The analysis shows that the number of Danish farmers with a negative net income in 2020 will increase from 25 percent to 45 percent after the introduction of the carbon tax. Especially cattle farmers are affected, while the implications are less adverse for crop and pig farmers. As a consequence, a carbon tax will most likely stimulate a transition away from cattle production towards crop and pig production or towards other less carbon-intensive farming systems.

Supplementary policies such as governmental subsidies can be introduced to mitigate the negative effects on farm income, should such policies be desired politically. Although the effects of such policies are not studied in the analysis, it should be noted that such policies risk lowering the incentive to mitigate emissions or creating carbon lock-in effects (i.e. a continued reliance on carbon-intensive agriculture). Consequently, the cost effectiveness of the policy may be reduced, increasing the overall socio-economic costs. In addition, such supplementary policies may increase government expenditures or reduce the incentive for structural changes.

Another factor not covered directly in the analysis, but worthy of note, is the way in which climate policies for agriculture can interact with other policies targeted on the aquatic environment and biodiversity. The effects of such interacting policies depend on the technical abatement measures implemented as well as on how a transition from cattle to less carbon-intensive farming systems takes place. Hence, it is important for decision-makers to be aware of both the positive and negative side-effects on biodiversity and the environment when introducing a carbon tax policy and possible supplementary policies.

Recommendations

Recommendations from the Danish Council on Climate Change

The DCCC offers the following recommendations for ensuring the agricultural adaptation to meet greenhouse gas reduction targets:

- Adopt a tax policy on agricultural greenhouse gas emissions. A tax is a key instrument to create incentives for reducing agricultural greenhouse gas emissions. A tax will provide incentives for both technical and structural changes towards less greenhouse gas emissions from agriculture and provide incentives for market-driven research and development.
- Announce a tax policy framework as soon as possible to ensure clear incentives for future agricultural activities.

A tax should follow these recommendations:

- The tax should be implemented well before 2030 and the government should announce the expected policy framework as soon as possible.
- The DCCC recommends the tax level to be sufficiently high to provide 1) incentives for structural changes from especially cattle farming to less carbon-intensive production systems, and 2) incentives for ensuring market-driven research and innovation of new abatement technologies.
- The DCCC recommends the Danish government puts forward a plan for the dynamic development of the tax level to reflect the goal of long-term climate neutrality by 2050.

A narrow focus on technical changes could counteract Denmark's long-term climate neutrality goal

A narrow focus on technical abatement measures may be incompatible with Denmark's long-term goal of climate neutrality by 2050. Support for technologies that create dependency on specific carbon-intensive production should be avoided. To exemplify, this could be support for excessive development of biogas production with high dependency on animal manure or technologies for livestock housing systems with a long depreciation period. Contrary to this, subsidising structural production changes could bring Denmark closer to reaching reduction targets and at the same time lower the risk of losing jobs to other countries and reducing Danish competitiveness in relation to other countries. Therefore, the DCCC recommends that government subsidies in general are not targeted at specific technologies that risk carbon lock-in, rather subsidies should be targeted at technologies that are in alignment with Denmark's long-term reduction targets.

The tax policy should account for permanence and decreasing net effect of carbon sequestration

A carbon tax on agricultural greenhouse gas emissions has a great potential to accelerate carbon sequestration and storage. However, it remains a key governance challenge to ensure permanence of carbon sequestration in soil and other types of biomass. It is estimated that 50 percent of the greenhouse gas reductions projected in this report stem from increased carbon sequestration and storage, for example through afforestation and catch crops. Nevertheless, these reductions are not necessarily permanent and some types of carbon sequestration and storage will have a decreasing net effect over time. Therefore, carbon sequestration activities may not be sufficient for offsetting long-term emissions. The government should take these long-term issues into account when designing the carbon tax policy framework by focusing on carbon changes or by defining permanence requirements and ensuring that the decreasing net effect over time is accounted for.

A dedicated focus on reductions in methane emissions is required

A uniform carbon tax on greenhouse gas emissions does not differentiate between climate effects from gases that are short lived, such as methane, and long lived, such as carbon dioxide and nitrous oxide. In the short run, however, methane emissions are a very powerful, potent greenhouse gas, as described in the DCCC analysis *Denmark's Climate Targets*. In recognition of methane's great impact on global warming, Denmark has joined the Global Methane Pledge. The carbon tax analysis summarised in this policy brief shows that a tax of DKK 750 per tonne CO₂e will lead to a 20 percent reduction of methane emissions, driven by technical abatement measures. The DCCC recommends the design of appropriate incentives to encourage even further reductions in methane emissions, especially within the dairy sector.

