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Swedish Environmental Emissions Data

Use of ETS data in the GHG inventory

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SMED is short for Swedish Environmental Emissions Data, which is a collaboration between IVL Swedish Environmental Research Institute, SCB Statistics Sweden, SLU Swedish University of Agricultural Sciences, and SMHI Swedish Meteorological and Hydrological Institute. The work co-operation within SMED commenced during 2001 with the long-term aim of acquiring and developing expertise within emission statistics. Through a long-term contract for the Swedish Environmental Protection Agency extending until 2014, SMED is heavily involved in all work related to Sweden's international reporting obligations on emissions to air and water, waste and hazardous substances. A central objective of the SMED collaboration is to develop and operate national emission databases and offer related services to clients such as national, regional and local governmental authorities, air and water quality management districts, as well as industry. For more information visit SMED's website www.smed.se.

Content

Sammanfattning

Huvudsyftet med Sveriges årliga rapportering till UNFCCC, EU Monitoring Mechanism och CLRTAP är att redovisa så korrekta data som möjligt över de totala utsläppen på nationell nivå. Förbränningsrelaterade utsläpp beräknas utifrån aktivitetsdata i form av bränsleförbrukning och emissionsfaktorer och värmevärden för respektive bränsle.

Systemet för handel med utsläppsrätter för koldioxid, ETS, omfattar anläggningar inom många olika sektorer inom den internationella rapporteringen. Syftet med föreliggande projekt är att sammanställa information om vilka datakällor som används idag för beräkning av utsläpp inom dessa sektorer för den internationella rapporteringen, samt för- och nackdelar med att använda handelsdata, dvs. data som rapporterats till Naturvårdsverket inom ramen för ETS, i större utsträckning än idag. Dessutom redovisas vad som krävs för att man i framtiden skall kunna sära på den handlande och icke handlande sektorn. Sammanställningen baseras på den kunskap som finns inom SMED beträffande utsläppshandelsdata och data till internationell rapportering från tidigare gjorda studier.

Idag är den huvudsakliga datakällan till den internationella rapporteringen SCB:s kvartalsvisa bränslestatistik som omfattar ca 1100 anläggningar. I de flesta fall används nationella emissionsfaktorer och värmevärden. Omkring 700 anläggningar ingår i ETS. Dessa anläggningar rapporterar årligen in utsläpp av koldioxid samt i de flesta fall bakomliggande förbrukning av bränslen och råvaror till Naturvårdsverket.

Fördelarna med ökad användning av handelsdata vore störst för de sektorer där den kvartalsvisa bränslestatistiken är av tveksam kvalitet och/eller utsläppen är stora och har en betydande inverkan på de totala utsläppen på nationell nivå. Förutsättningarna är naturligtvis olika för olika sektorer. Om handelsdata skulle utnyttjas i största möjliga utsträckning för samtliga sektorer skulle den årliga kostnaden för den internationella rapporteringen öka med ca 225 000 kr.

Denna studie visar att de största fördelarna med ökad användning av handelsdata finns inom sektorerna 1A1b – oljeraffinering, 1A2d – pappers- och massaindustri, samt generellt inom CRF 2, dvs. utsläpp från industriprocesser.

För ett antal andra CRF kategorier kan det inte styrkas att ökat utnyttjande av handelsdata skulle förbättra kvaliteten på utsläppsstatistiken, och alltså vore det inte kostnadseffektivt att använda handelsdata för dessa sektorer. Detta gäller t.ex. 1A1a, 1A2c, 1A2e och 1A2f.

För ett par sektorer, 1A1c och 1A2a, är det för närvarande inte möjligt att använda handelsdata överhuvudtaget.

Summary

The main objective of Sweden's yearly submissions to UNFCCC, EU Monitoring Mechanism and CLRTAP is to produce as accurate data as possible on the total emissions on national level. For fuel combustion, the reported emissions are calculated from activity data on fuel consumption and fuel specific emission factors and thermal values.

The objective of this project is to compile information on data sources used today for those sectors that are covered by the EU Emission Trading Scheme (ETS) for carbon dioxide (CO_2), and to identify any advantages or disadvantages with applying ETS data in the Swedish GHG inventory to a greater extent than today. The information is primarily assembled from earlier SMED reports on this subject. The issue of separating trading and non-trading plants is also addressed.

Today, the main source of activity data is Statistics Sweden's quarterly fuel survey (QS), which includes about 1100 plants. Mostly, national standard emission factor and thermal values are used to calculate the emissions. About 700 plants are part of the ETS. Every year, these plants report their emissions of CO_2 and in most cases the underlying consumption of fuels and raw materials to the Swedish Environmental Protection Agency.

The greatest benefits from an increased use of ETS data would be achieved for those CRF sectors where the QS data is of questionable quality and/or the emissions are large and thus considerably contributes to the national totals. The prerequisites are, of course, different for different sectors. If ETS data should be used to the greatest extent possible for every sector, this would imply an additional cost of approx. SEK 200 000 per year.

This study shows that the CRF categories where it would be most beneficial to use ETS data to the greatest possible extent are 1A1b – oil refineries, 1A2d – pulp, paper and print, and CRF 2 in general, that is, process-related emissions.

For a number of other CRF categories, it cannot be concluded that the data quality would be improved, and thus it would not be cost effective to use ETS data for these sectors, e.g. 1A1a, 1A2c, 1A2e and 1A2f.

For a couple of categories, 1A1c and 1A2a, it is currently not possible to use ETS data for those plants that have the greatest emissions due to insufficient allocation of the emissions in the reporting to the ETS.

Background and objective

The main objective of Sweden's yearly submissions to UNFCCC, EU Monitoring Mechanism and CLRTAP is to produce as accurate data as possible on the total emissions on the national level. To achieve this, a number of different data sources are used. The main source for activity data for stationary combustion in the energy sector is the energy statistics from Statistics Sweden; in particular the quarterly fuel statistics, which includes data from about 1100 plants. About 700 of these plants are part of the Emission Trading Scheme (ETS) for carbon dioxide (CO_2). Every year, these plants report their emissions of CO_2 and in most cases the underlying consumption of fuels and raw materials to the Swedish Environmental Protection Agency (EPA).

Since 2003, SMED has conducted a number of studies where ETS data has been compared with data from other sources, mainly the quarterly energy statistics. The main objectives of these studies have been to verify ETS data or to make the GHG inventory data as correct and consistent as possible. The findings from all these studies could collectively provide a good basis for an evaluation of where increased use of ETS data could improve the quality of the GHG inventory.

Objective

The objective of this project is to compile information on data sources used today for those CRF categories that are covered by the ETS, and to identify any advantages or disadvantages with applying ETS data to a greater extent than today, including difficulties with identifying the trading plants in the currently used data sources. The information will primarily be assembled from earlier SMED reports on this subject.

Scope of the work

This project does not include any recalculations of time series or production of new data for comparisons between GHG inventory data and ETS data. The project only comprises a compilation and analysis of earlier studies carried out by SMED.

Method

The analysis is carried out separately for each CRF category. The reporting format is divided into main groups according to the type of emissions. For industrial plants and electricity, gas and heating plants there are energy emissions including combustion emissions (CRF 1A) and diffuse emissions (CRF 1B), and process emissions (CRF 2). The classification is determined by the main purpose of the fuel consumption, which can be very complicated for certain industrial plants.[1]

After a short description of the CRF category and which data sources that have been used in recent years, an assessment of any advantages and disadvantages with a more extensive use of ETS data in the GHG inventory is made. Some plants, i.e. within the iron and steel industry, have both energy- and process-related emissions and are hence included in more than one CRF category. This also implies that in some cases different data sources are used for different kinds of emissions from the same plant. The evaluation of advantages and disadvantages with more extensive use of ETS data in the GHG inventory is based on results and conclusions from earlier SMED studies. Finally, a recommendation is made for whether or not more extensive use of ETS data should be initiated for some of the categories. Moreover, a description of which measures that are needed to separate trading and non trading plants in the GHG inventory is included.

The descriptions of different industries are based on SNI 2002, which corresponds to the ISIC groups in NACE Rev.1. This classification is not entirely in a one-to-one relation to the CRF classification because one plant can have several types of emissions and therefore be included in more than one CRF category. This is true for many industrial plants which often have both energy related (CRF 1) and process related (CRF 2) emissions.

Data sources used in the GHG inventory

Quarterly fuel survey

The main source of activity data is Statistics Sweden's quarterly fuel survey (QS), the main purpose of which is to describe the short-term variations in the supply and use of fuels within industrial plants and electricity, gas, and heating plants. The survey is a postal survey and includes about 1100 plants in total. For the energy plants (ISIC 40), the survey is a total survey, but since all plants within one municipality belonging to the same company are aggregated to one responding unit, it is

[1] Lidén & Nyström, 2004.

in some cases (that is, for large companies with many plants within the same municipality) not possible to identify the fuel consumption on plant level.[2]

For the industrial plants (ISIC 10-37), the sample includes all companies in the pulp and paper industry and all companies in the manufacturing industry with more than nine employees and annual fuel combustion of more than 325 toes. To compensate for companies not included in the sample and companies not responding to the survey, all fuel consumption is enumerated with an enumeration factor which is produced from information on the line of business, number of employees and business volume from the most recent year when the industrial energy statistics was a total survey (as discussed above). There is, however, no enumeration for manufacturing industries with less than 10 employees.

From 2005 onwards, it is possible to obtain both enumerated and non-enumerated data on fuel consumption from the QS, which makes it easier to compare the data with e.g. ETS data. In several earlier comparisons, QS has shown to differ from e.g. information obtained by direct contact with the companies to such a great extent that QS data has been replaced by data from other sources, despite the problem with the sample adjustment. However, as long as only a small number of observations are exchanged this is of little consequence.

Industrial energy statistics

For a few large plants within chemical industry and pulp and paper industry the activity data is taken from the industrial energy statistics, that is, statistics on the yearly energy consumption in industrial plants. The purpose of this statistics is to describe the use of different energy carriers (fuels, electricity and heat) for different industries. All local units with ten or more employees within ISIC 10-37 are included in the survey, and the energy consumption of local units with fewer than ten employees is calculated by means of a model estimate based on the energy consumption per employee in the plants with 10-19 employees in each industry. To some extent, the respondents are allowed to report estimated consumed quantities.

Emission Trading Scheme (ETS Data)

When companies report to the ETS, plant specific emission factors are used in most cases. Most plants report both activity data, i.e. quantities of combusted fuels, and emission data, and thus emission factors can be derived from the data. However, in the GHG inventory, national standard emission factors are mostly used even in those cases where ETS data is used for activity data. For other substances than CO_2, national emission factors will have to be used as long as only CO_2 is included in the ETS.

[2] Backman & Gustafsson, 2006.

For energy related emissions (CRF 1), ETS data has so far been used mainly for oil refineries. Activity data from the ETS has been used to a great extent for process related emissions (CRF 2), but for most of the plants this was combined with national emission factors, which may differ from the emissions factors used by the plants in their reporting to the ETS. For some process related emissions ETS was however the main data source in the calculations of emissions in the year 2005.

Only fossil CO_2-emissions are included in the ETS. Within the ETS, the emissions are classified as either fuel-related or related to raw material. The fuel combustion is separated in two categories: fossil fuels and mixed fossil and biomass fuels, and the raw material related emissions are separated in the same way. Generally speaking, these definitions can be translated to the CRF classification; fuel related emissions correspond to energy emissions (CRF 1) and raw material related emissions correspond to process emissions (CRF 2). There are, however, some differences. Within the ETS, emissions from plants with catalytic cracking and hydrogen production are classified as related to raw material, whereas they according to the IPCC Guidelines should be classified as energy-related emissions.[3]

Other data sources

For process related emissions (CRF2) the companies' environmental reports are used extensively. These contain both information on activity data and emission data on plant level. However, national emission factors and thermal values are mostly used in the national inventory.

In cases where sufficient information cannot be obtained from any of the sources mentioned above, the plants are contacted by SMED and asked to provide information on fuel consumption and emissions.

Overview of earlier studies

Before the ETS was introduced in 2005, SMED produced data to be used as a basis for Sweden's National Allocation Plan (NAP), on behalf of the Swedish EPA. A questionnaire designed for emission reporting was sent to the about 500 plants that, at that time, were considered to be affected by the ETS.[4]

In many cases, the activity data recorded turned out to be more complete than activity data from e.g. the QS. This was probably due to the design of the questionnaire and the strong incentive to account for complete information about all emis-

[3] Backman & Gustafsson, 2006.
[4] Nyström & Cooper, 2005.

sions in order to get as many allowances as possible. This raised the question of whether ETS data could be used in the GHG inventory.[5]

The earlier SMED studies on differences between GHG inventory data and ETS data have shown that the discrepancies between the two in some cases are considerable. There are a number of different reasons for this:

- When emissions are calculated from the QS, standardized national emission factors and thermal values are used. Hence, they are not entirely correct on plant level.

- The reported fuel quantities and the classification of emissions as fossil or biogenic in many cases differ somewhat between the two surveys.

- As ETS data are verified and reported after the end of the year and not divided quarterly, they are to be considered as more accurate than QS activity data.[6]

One conclusion from these studies is that ETS data advantageously could be used for some process-related emissions, whereas the advantages for energy-related emissions are considered to be more dubious.[7] The earlier mentioned sample adjustment of data in the QS in order to compensate for the plants not included in the survey has been considered as a general problem in the earlier studies, as it could cause over- or underestimation of emissions on the national total level. From 2005 onwards, however, non-adjusted data are available, and thus this is no longer a problem.

Another problem with ETS data is that some plants, e.g. all the SSAB plants that account for a very large part of the emissions of fossil CO_2 from stationary combustion, only report carbon mass balances, i.e. amounts of CO_2, to the ETS. This is not sufficient for the calculation of energy-related emissions. On one hand, allocation of the emissions to different fuel types is required in the GHG inventory, and on the other hand activity data for different fuels is needed to calculate emissions of other substances than CO_2. Besides, the database CRF Reporter is constructed in such a way that energy amounts must be registered in terms of activity data.

[5] Backman & Gustafsson, 2006.
[6] Nyström, 2007.
[7] Lidén & Nyström, 2004.

Results and analysis

CRF 1A1a, Public electricity and heat prod.

Description

This sector includes all emissions from public electricity generation, public combined heat and power generation, and public heat plants. Emissions from own on-site use of fuels are included, but emissions from manufacturers, which generate electricity or heat for their own use in support of their primary activity, are assigned to the category where they were generated and not to CRF 1A1a. In total, about 35 % of Sweden's emissions of fossil CO_2 from stationary combustion are assigned to CRF 1A1a.

Data sources in submission 2008

In 2005 and 2006, the QS was the main data source within CRF 1A1a, accounting for more than 99 % of the CO_2 emissions. The remaining data was collected through direct contacts with the plants. ETS data was not used. As mentioned earlier, the QS is a total survey in this sector, i.e. all fuel consumption within CRF 1A1a is included. The number of responding units is about 270. The actual number of plants is higher, because in the QS, all plants within one municipality belonging to the same company are aggregated into one responding unit.

In addition, some energy-related emissions from SSAB are presently included in this category, accounting for about 3,5 % of the emissions of fossil CO_2 within CRF 1A1a in 2005. In an on-going SMED investigation related to the GHG inventory it will be proposed that the emissions from the energy plant from SSAB in Oxelösund should be reported under CRF 1A2a instead, as these emissions are caused directly by the steel production. In total, about one third of Sweden's emissions of fossil CO_2 from stationary combustion are assigned to CRF 1A1a.

Plants included in the ETS

Within CRF 1A1a, the ETS includes combustion installations with a rated thermal input exceeding 20 MW and all smaller combustion installations connected to a district heating grid with an aggregate installed capacity exceeding 20 MW. During the first trading period, 2005-2007, installations that mainly incinerate municipal waste or hazardous waste were excluded, as were kilns and ovens. Following the recommendation from the EU Commission, from 2008 onwards the definition has been broadened to include all combustion installations irrespective of fuel and irrespective of the purpose of the combustion.[8] About 450 plants within this sector are included in the ETS.

[8] Sweden's National Inventory Report, submission 2008, annex 9

Findings from earlier studies

Plant level comparisons between ETS data and QS data has been made in earlier studies. Backman & Gustafsson (2006) showed large discrepancies for certain plants within CRF 1A1a. The discrepancies are partly due to the fact that combustion of municipal waste is not included in the ETS data, but nevertheless some plants showed significant differences after adjustment for this fact. [9] Because of this, these plants were investigated more thoroughly in a follow-up study. This study showed that the differences are caused partly by how different fuels are classified in the QS, and partly by the use of standardized national emission factors. Besides, it is probably not always possible to produce correct data every quarter of the year, and thus the fuel quantities are in some case estimated.[10]

One conclusion to be drawn from this study is that use of ETS data for some plants might improve the quality of the emission statistics. Nyström (2007) recommended that ETS data should be used in future submissions for all plants within "AB Fortum Värme samägt med Stockholms stad" and for Mälarenergi AB in Västerås. In some other cases, differences in the allocation of fuels between fossil and biogenic fuels, respectively, were identified. Nevertheless, the quality of the present main data source, the QS, is generally considered to be very high. It is, however, possible to improve the quality of the emission statistics by means of revision of emission factors and minor changes in the classification of certain unusual fuels. The choice of data source is also affected by how large differences between ETS data and GHG inventory data that can be internationally accepted. If no differences are accepted, ETS data has to be used.[11]

Advantages and disadvantages with increased use of ETS data

The possible advantage is the improved coherence between the GHG inventory and ETS data that would result from increased use of ETS data.

There are, however, a number of drawbacks with using ETS data for this sector. As mentioned above, for a number of large companies data on fuel consumption is not collected on plant level, and hence the data might include fuel consumption in plants that are too small to be included in the ETS. If this data is replaced by ETS data, the result will be that some small plants might "drop out" of the statistics. This, in turn, could lead to an underestimation of the total CO_2 emissions from category CRF 1A1a on a national total level.

Furthermore, in CRF 1A1a every observation in the QS does not have a unique number for the identification needed to enable replacement of QS observations with ETS data. Normally, the so called Cfarnr is used for this identification. A

[9] Backman & Gustafsson, 2006.
[10] Nyström, 2007.
[11] Ibid.

unique Cfarnr is assigned to every local unit that is registered in the FDB. Within ISIC 40, however, one responding unit in the QS in many cases includes several plants, and thus the Cfarnr is not applicable for many observations as these observations are not connected to individual plants. Without the possibility of using Cfarnr, the matching must be done manually. This has been investigated in previous SMED studies, and it has been found that manual matching cannot be recommended due to the substantial risk of errors, which in turn leads to increased uncertainty in the data.[12]

Conclusion

It is with no doubt possible to use ETS data for a large number of plants. This would however, as mentioned above, be quite complicated, and it has not been shown that the data quality would be significantly improved. Thus SMED does not recommend extended use of ETS data for this sector.

CRF 1A1b, Petroleum refining

Description

This CRF category includes all combustion activities supporting the refining of petroleum products. There are five oil refineries in Sweden, and in addition to these the sector includes some smaller plants performing related activities, e.g. manufacture of lubricants. The category accounts for about 10% of all CO_2 emissions from stationary combustion within the energy sector in Sweden.

Data sources in submission 2008

The five oil refineries account for more than 99 % of the emissions within CRF 1A1b. In the latest submission, activity data from the ETS was used for four of the five refineries, accounting for 75 -80 % of the emissions. For the fifth refinery and two manufacturers of oil-based lubricants and similar products, QS data was used. National standard emission factors and thermal values were used for all plants.

Plants included in the ETS

All of the refineries included in the GHG inventory are included in the ETS. As these account for almost all emissions of fossil CO_2 within CRF1A1b, emissions from non-trading plants are practically insignificant.

Findings from earlier studies

In one of the earlier SMED projects, where emission data for the years 2000 and 2001 were studied, some differences between GHG inventory data (i.e. activity data from QS + national emission factors and thermal values) and data from the preparatory emission trading survey were identified. These differences were partly

[12] Gustafsson, Lidén & Nyström 2005.

due to that the refineries used other emission factors than the national standard factors for petroleum coke and refinery gas. Because of this, the standard emission factors for these fuels were revised in a following project.[13] In a later study, where activity data from the ETS were compared to the QS for the year 2005, four refineries were included. Significant discrepancies were discovered for three of these, and the ETS was recommended as data source because ETS data are verified and hence can be assumed to be more correct than QS data. For the fourth refinery, Preemraff Göteborg, the discrepancy was not significant and hence the QS data was used in line with the policy at the time to use QS in as many cases as possible.[14] (The fifth refinery had too small emissions to be included in that particular study.)

Advantages and disadvantages with increased use of ETS data

As mentioned above, national standard emission factors and thermal values are used even when activity data are obtained from ETS data. This implies that GHG inventory data will always be somewhat different from the ETS data. If, however, ETS data would be used for all five refineries, regarding both activity data and plant specific emission factors and thermal values, a one-to-one relation between SMED data and ETS data would be achieved. This could be done quite easily due to the very small number of plants. For this CRF category, there are no major disadvantages with increased use of ETS data.

Conclusion

SMED can recommend use of ETS data for all trading plants, regarding activity data, emission factors and thermal values. This implies that the GHG inventory and ETS data would match for the trading plants.

CRF 1A1c, Manufacture of solid fuels and other energy industries

Description

This category presently includes some of the emissions from SSAB:s steelworks in Luleå and Oxelösund. (As mentioned earlier, the allocation of SSAB:s emissions are currently investigated in another SMED study.) Emissions from plants within ISIC group 233, manufacture of nuclear fuels, are also allocated to this category. These plants, however, generate very small emissions (less than 0,5 % of the emissions of fossil CO_2 within the category). CRF 1A1c accounts for a very small fraction, about 1,5 %, of the emissions of fossil CO_2 from stationary combustion in Sweden.

[13] Gustafsson, Lidén & Nyström, 2005.
[14] Backman & Gustafsson, 2006.

Data sources in submission 2008

The only data source used in 2005 and 2006 was the QS.

Plants included in the ETS

The two SSAB plants mentioned above are included in the ETS. None of the nuclear fuel manufacturers are included.

Findings from earlier studies

This category has not been studied separately in any of the earlier SMED projects, but emissions from SSAB have been investigated in e.g. Backman & Gustafsson 2006. For plants with part of their emissions allocated to CRF 1A1c, the difference between ETS data and QS data on aggregate plant level (that is, not separated by CRF code) was insignificant.
The possibility of using ETS data for SSAB in the GHG inventory is currently investigated more thoroughly in the study "Fortsättning av riktad kvalitetskontrollstudie av utsläpp från industrin i Sveriges internationella rapportering". It is however problematic that the emissions from the coke-oven plants are not reported separately in the ETS and thus they cannot easily be used in the GHG inventory data. These emissions are also not reported separately in the QS, but separated activity data is available from the background data that is used to produce the QS.

Conclusion

Because of the problems associated with allocation of emissions over several CRF codes, it is currently not possible to use data reported to the ETS in the GHG inventory for this category.

CRF 1A2a, Iron and steel production

Description

CRF 1A2a accounts for about 5 % of the emissions of fossil CO_2 from stationary combustion. The plants within this sector produce various kinds of crude iron, unprocessed forms of stainless steel or other steel alloys, and other iron or steel products. A few very large plants account for the vast majority of the CO_2 emissions within the sector. Because of this, only about 30 plants are included in the QS.

Some of these plants also have energy related emissions reported in the CRF categories 1A1a, 1A1c and 1B1c and process emissions reported in CRF category 2C1.

Data sources in submission 2008

All data in the GHG inventory for emissions in 2005 and 2006 were calculated based on activity data from the QS and national standard emission factors and thermal values. ETS data has not been used.

Plants included in the ETS

According to Swedish EPA, 15 plants in the iron and steel manufacturing industry are included in the ETS. In the GHG inventory data for 2005, these plants accounted for 89 % of the emissions of fossil CO_2 from the sector. During the next trading period, four additional plants will be included.

Findings from earlier studies

In previous studies, it has been concluded that the energy statistics is the preferable data source for combustion emissions from the iron and steel industry. This is due to the fact that the IPCC Guidelines require a division in emissions from coke-oven plants, flaring, process emissions and other emissions from the steelworks. The energy statistic can provide data divided in this way, and the emission calculations in the GHG inventory are based on the residual gases that are generated by the plant. To the ETS, however, e.g. SSAB reports the emissions by means of mass balances based on in- and outgoing carbon in raw materials and reducing agents, and this information is not sufficient to allocate the emissions correctly between the CRF categories. The discrepancies between GHG inventory data and ETS data that have been discovered for this category have shown to depend on different allocations of emissions, on one hand allocation between different plants within SSAB, and on the other hand allocation between combustion and process emissions.[15] As mentioned above, the allocation of emissions from SSAB is currently investigated by SMED in another project related to the GHG inventory.

Advantages and disadvantages with increased use of ETS data

The possible advantage with using ETS data for the GHG inventory would be better agreement between GHG inventory data and data reported to the ETS.

Within this particular CRF category, however, ETS data cannot be used for the SSAB plants that account for a very large part of the emissions. This is due to that the emissions from steelworks are allocated to several different CRF categories in the GHG inventory depending on the type and purpose of the combustion of fuels. To the ETS, SSAB does not report the emissions separated in this way, and thus ETS data cannot be used in the inventory. To use ETS data for a number of plants with relatively small emissions would be time-consuming and imply extra work, without improving the quality of the GHG inventory data.

[15] Gustafsson, Lidén & Nyström 2005.

Conclusion

At present, use of ETS data cannot be recommended for this category. It would be possible for some plants, but not for the most important ones.

CRF 1A2b, Manufacturing of Non-Ferrous Metals

Description

In this sector, the main sub industries are manufacturing of aluminium (about 70 plants), and casting of light metal (about 120 plants). Only a few of the plants have combustion related fuel consumption high enough to be included in the energy statistics. The emissions from this category are small compared to other sectors and account for about 0,4 % of the total fossil CO_2 emissions from stationary combustion within the energy sector.

Data sources in submission 2008

All emissions were calculated using QS activity data and national standard emission factors and thermal values. In 2005 and 2006, 12 plants in this category were included in the GHG inventory.

Plants included in the ETS

Three plants were included in the ETS, and in the GHG inventory data these plants accounted for 44 % of the calculated emissions of fossil CO_2 within CRF 1A2b in 2005.

Findings from earlier studies

None of the three plants included in the ETS have emissions large enough to be included in any of the previous SMED studies. Hence, it is not possible to evaluate the possibility of using ETS data in the GHG inventory for this category based on previous studies. All three plants report energy-related emissions and thus it would be possible to use ETS data for these plants.

Advantages and disadvantages with increased use of ETS data

Provided that ETS data reported under energy is compliant with the emissions reported in the GHG inventory, it would be feasible to use ETS data for the three plants included in the ETS. If there are differences between the two datasets, it might be good two investigate the reasons for these and to evaluate which dataset that provides the information most appropriate for the GHG inventory. However, it is not within the scope of this project to make such a comparison. If data from the ETS was to be used it would have the advantage of perfect agreement between ETS data and GHG inventory data for the three plants included in the ETS. The disadvantage with using ETS data would however be the need for additional work when

preparing the GHG inventory without knowing weather or not it would improve the quality of the GHG inventory.

Conclusion

Since there are presently no data on how the ETS data matches the GHG data it is difficult to evaluate whether or not the use of ETS data would improve the quality of the GHG inventory. Until it has been established whether or not the ETS data would provide more accurate data than the QS for the three plants included in the ETS, we do not recommend the use of ETS data for this category.

Chemical Industries, CRF 1A2c

Description

Within the chemical industry, the plants with the largest combustion-related emissions of CO_2 are found within the sub-industries of manufacture of plastics in primary forms, (about 70 plants accounting for almost 60 % of the emissions), manufacturing of other organic basic chemicals (about 130 plants accounting for about 20 % of the emissions), and manufacturing of other inorganic basic chemicals (about 80 plants, 14 % of the emissions). The remaining 6 % of the emissions are mainly originating from plants manufacturing pharmaceutical products or glue, gelatine etc. In total, CRF 1A2c accounts for about 7 % of the emissions of fossil CO_2 from stationary combustion.

Data sources in submission 2008

For the majority of the about 80 plants in the GHG inventory 2005 and 2006 the QS was used as data source. The industrial energy statistics was used for a few large-scale manufacturers of plastic (eleven plants) and organic basic chemicals (five plants). These 16 plants accounted for 53-54 % of the CO_2 emissions within CRF 1A2c in 2005-2006. ETS data has not been used.

Plants included the ETS

13 plants within CRF 1A2c are included in the ETS. In the GHG inventory data, these plants accounted for 87 % of the CO_2 emissions from this category in 2005.

Findings from earlier studies

One of the earlier studies by SMED found some deficits in the energy statistics for this sector, and recommended that ETS data should be used to verify the QS data.[16] This was done in a follow-up study, which concluded that, generally speaking, there is a good agreement between GHG inventory data and ETS data, within CRF 1A2c.[17]

[16] Lidén & Nyström 2004.
[17] Gustafsson, Lidén & Nyström, 2005.

There are however exceptions. One of the earlier studies consisted of a detailed study of plants that had shown large discrepancies between GHG inventory data and ETS data. The study showed that ETS data could not be used to calculate emissions for a couple of plants with large emissions. One plant, Perstorp Oxo, did only report mass balances of in- and outgoing carbon and no activity data for the various fuels used. For this plant the QS also contained some erroneous data, and because of this further studies were recommended.

Another plant, Borealis AB, showed discrepancies due to that only their energy production was included in the ETS during the first trading period, whereas the QS data includes fuels used within the industrial processes, as well as fuels used for energy production. In the second trading period, however, all emissions from this plant will be included in the ETS. Hence further investigations might be interesting in 2009, when emissions from the first year of the second trading period are reported, but until then no further actions are considered needed according to this study.[18]

Advantages and disadvantages with increased use of ETS data

If full consistency between the GHG inventory and ETS data is required, both activity data and emission factors and thermal values from ETS data must be used in the GHG inventory. The plants included in the ETS are quite few, and thus the extra work with identifying them and remove the observations from the QS data set would not be very time consuming. The plants not included in the ETS account for only a minor part of the emissions within this sector, and hence the ETS data would be of great importance to the total sum of calculated emissions from this sector.

One major disadvantage can be extracted from the findings from earlier studies: It may not be possible to use ETS data for a couple of plants with large emissions, e.g. Perstorp Oxo AB, as mentioned above. If this is the case, the benefits from using ETS data would probably not be significant.

Conclusion

The conclusion to be drawn about this sector is that the agreement between ETS data and the data sources currently used for the GHG inventory, (i.e. Industrial statistics and QS), is generally very good and thus the currently used sources can be assumed to give high data quality. This could indicate that use of ETS data would increase the costs without significantly improving the data quality, and thus cannot be recommended.

[18] Nyström, 2007.

Pulp, paper and print, CRF 1A2d

Description

This sector, which accounts for about 9 % of the emissions of fossil CO2 from stationary combustion, includes all kinds of plants within the pulp, paper and print industries. In 50 of these plants various kinds of pulp, i.e. sulphate- or sulphite pulp or mechanic or semi-chemical pulp are produced, which can cause high emissions of both fossil and biogenic CO_2. The other plants in this category produce various kinds of board, paper products and board and paper packaging, e.g. cardboards, envelopes and newsprint, and these activities generate much lower emissions.

Data sources in submission 2008

In the GHG inventory, emissions from about 250 plants within CRF 1A2d are included. The QS was the dominating data source for the emissions in 2005 and the only one used for 2006. For 2005 emissions, industrial statistics data was used for one plant, accounting for about 11 % of the emissions of fossil CO_2 within CRF 1A2d. ETS data has not been used.

Plants included in the ETS

About 60 plants are included in the ETS. In the GHG inventory data, these plants account for more than 95 % of the emissions of fossil CO_2 within CRF 1A2d.

Findings from earlier studies

Plants within CRF 1A2d have been investigated in several earlier SMED studies, where it was found that the discrepancies between GHG inventory data and ETS were considerable in several cases. A number of errors (double counting etc.) that were identified have since then been corrected. During the process it was discovered that for some plants, data to the QS and to the ETS are reported by different departments, and upon contact, one of them emphasised that QS data is not meant to be used in emission calculations.[19]

Advantages and disadvantages with increased use of ETS data

The findings from earlier studies indicate that increased use of activity data from ETS data could improve the quality of the GHG inventory data for this sector. To reach full consistency with ETS data, however, plant specific emission factors would have to be derived from the ETS data and used in the GHG inventory.

One of the earlier studies showed that most plants (accounting for almost 90 % of the CO_2 emissions within the sector) could be identified by Cfarnr in both QS data and ETS data, and thus the matching and replacement procedures (discussed in more detail later on in this report) could be done relatively easily for this sector.[20]

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[19] Nyström & Cooper 2005.
[20] Gustafsson, Lidén & Nyström, 2005.

However, as for all sectors, it would be time consuming to replace a considerable number of observations manually from the QS dataset. Although the conditions for matching are good compared to most other sectors, it is not perfect, and hence errors could occur.

Conclusion

This is one of the few sectors where extensive use of ETS data could, in fact, improve the data quality. A very large share of the emissions originates from plants included in the ETS, and ETS data has shown to be of high quality.

CRF 1A2e, Food Processing, Beverages and Tobacco

Description

The emissions of fossil CO_2 within CRF 1A2e are relatively small, representing 2-3 % of the emissions from stationary combustion. Most plants within the food industry do not report any fuel consumption and thus they have no combustion-related emissions. The largest emissions within the sector are reported from sugar mills.

Data sources in submission 2008

About 160 plants in CRF 1A2e are included in the GHG inventory. For 2005, the QS was the only data source. However, for 2006 ETS data was used for two of the fuel types combusted in the Danisco Sugar plant Örtofta Sockerbruk due to temporary problems with the QS data. The ETS data accounted for about 11 % of the CO_2-emissions in this category in 2006.

Plants included in the ETS

15 plants with emissions within CRF 1A2e are included in the ETS. In the GHG inventory data for 2005 and 2006, these plants account for about 30 % of the emissions of fossil CO_2 within this category.

Findings from earlier studies

One of the previous SMED studies recommended that QS data should be used for the Danisco Sugar plants in Örtofta and Köpingebro, as not all fuels were included in the ETS data. For those fuels included, however, the coherence was good between QS and ETS data.[21] However, in the second trading period 2008-2012, all emissions from these two plants will be included in the ETS. This means that the possibility of using ETS data for this sector will increase in the future.

[21] Backman & Gustafsson, 2006.

Advantages and disadvantages with increased use of ETS data

ETS data is already used for this category, although not to the largest possible extent. However, as the majority of the emissions within this category originate from non trading plants, and the sector accounts for a relatively small part of Sweden's total emissions from stationary combustion, there are no obvious advantages with increased use of ETS data for this sub sector.

Use of ETS data to the greatest possible extent would imply a considerable amount of extra work and manual operations that could possibly increase the risk for errors. Regarding that the emissions within this sector are small compared to other sectors, increased use of ETS data would have very little impact on the total emissions on the national level.

Conclusion

Increased use of ETS data is not recommended for this sub sector, because the data quality would not be significantly improved and the method would not be the most cost effective one.

CRF 1A2f, Other manufacturing industries

Description

In terms of number of plants, this category is very large and includes a wide range of plants. The largest sub-industries are manufacturing of metal products excluding machines and apparatus and manufacturing of wood products. The latter sub-industry causes high emissions of CO_2; however, the vast majority of these emissions are biogenic and thus not included in the ETS.

The sector accounts for about 13 % of the emissions of fossil CO_2 from stationary combustion in Sweden. The sub-industries with the largest emissions of fossil CO_2 are manufacturing of cement, lime and gypsum (ISIC 265), which accounts for about 35 % of the emissions of fossil CO_2 within CRF 1A2F, and mining (ISIC 13), which accounts for about 15 % of the emissions of fossil CO_2.

Data sources in submission 2008

The dominating data source in the GHG inventory for this sector is the QS, and for a small number of plants other kinds of energy statistics have been used. ETS data has not been used so far. For a number of plants with energy-related emissions within this CRF category, ETS data is already used for their process emissions. The number of plants included in the GHG inventory each year is about 360.

Plants included in the ETS

41 plants within CRF 1A2f were included in the ETS during the first trading period. In the GHG inventory data, these plants accounted for 68 % of the emissions of

fossil CO_2 within this category in 2005. Just over half of these emissions originated from manufacturing of cement and lime (ISIC 2651 and 2652). No non-trading plants were included in the GHG inventory in 2005 for these two sub-industries

Findings from earlier studies

Earlier studies have shown that the coherence between the GHG inventory, based on energy statistics, and ETS data is generally good. Most of the differences were due to erroneous allocations between process- and energy-related emissions for a few plants in the preparatory trading survey made in 2004.[22] The questionnaire answers from this survey also showed that the reported plant-specific emission factors for petroleum coke differed from the national standard ones used by SMED at the time, and as a consequence of this the national standard factor was revised in the second part of the project.[23]

These two studies also revealed a number of general deficits in the QS-based GHG inventory, but the recommendation that resulted from this was not to use ETS data, but to make certain efforts to correct these deficits and continue to use QS data in future submissions.

Advantages and disadvantages with increased use of ETS data

Earlier studies have shown deficits in the QS data for this sector, and thus use of ETS data for some plants might improve the data quality.

This category includes a large number of plants and observations, and hence the process of matching plants and replacing observations will imply a considerable amount of extra work. Still, about one third of the emissions within this sub sector cannot be taken from ETS data as these emissions originate from non-trading plants.

Conclusion

It is possible to use ETS data for the about 40 plants included in the ETS, accounting for about two thirds of the emissions. Earlier studies, however, give no evidence for that the data quality would be significantly improved. Thus they do not give any support for a decision to use ETS data in future submissions.

CRF 1B, Fugitive emissions from fuels

Description

Fugitive emissions are intentional or unintentional releases of gases from anthropogenic activities. In particular, they may arise from fuel related activities.[24] For

[22] Gustafsson, Lidén & Nyström, 2005.
[23] Nyström & Cooper, 2005.
[24] 1996 IPCC Guidelines

Sweden, emissions are reported in the sub categories 1B1c, 1B2a6 and 1B2c2.1. The sector accounts for about 3 % of the energy-related emissions of fossil CO_2.

Data sources in submission 2008

Category 1B1c includes emissions from flaring of gas, and the only plants included are the SSAB steelworks. The emissions within 1B1c, that accounted for about 85 % of the emissions within CRF 1B, were calculated from information obtained through direct contacts with the plants.

Category 1B2 includes fugitive emissions from oil and gas activities. These emissions may arise from equipment exhaust (non-combustion), leakages, upsets and mishaps at any point in the chain from production through final use. Emissions from flaring are also included, as the combustion is considered a non-productive activity. [25]

1B2a6, other fugitive emissions from oil activities, includes transfer losses of gas works gas, which are not related to any specific plants, and hence this category is not affected by the ETS. The emissions in this category amount to only about 0,01 % of the emissions from stationary combustion. The data on transfer losses of gas works gas are taken from Statistics Sweden's annual energy statistics.

The category 1B2c2.1 includes emissions from venting and flaring of gas. The category accounts for less than one percent of the emissions from stationary combustion. Eight plants report emissions within this sector: four steel producers, three oil refineries and one chemical industry plant. For the oil refineries, ETS data was used. The emissions from the other plants were estimated based on previously gained knowledge and in one case obtained via direct contact with the plant.

Plants included in the ETS

Practically all plants reporting emissions within CRF 1B are included in the ETS.

Findings from earlier studies

In one of the earlier studies it was found that data on flaring, which is reported in CRF 1B1c and 1B2c2.1, was missing in the QS, and it was concluded that ETS data could be used for information on flaring, under the condition that flaring is reported separately in the ETS data.[26] For SSAB, however, this is not the case, so it is currently not possible to use ETS data for CRF 1B1c.

Conclusion

This is a sector were a very small number of plants are included, and all those have the main part of their emissions in one or more other CRF categories. Thus, the

[25] Ibid.
[26] Lidén & Nyström, 2004

decision about this category depends on the decision for the individual plants – if ETS data is used for the emissions within other categories, it should be used in CRF 1B as well.

CRF 2A1, Cement production

Description

Emissions of process related CO_2 from cement production account for about 2 % of total national GHG emissions and about 24 % of the process related GHG emissions. Cement is manufactured at three facilities in Sweden, and all of these are included in the ETS.

Data sources in submission 2008

CO_2 emissions from ETS data are used for all plants. However, ETS data does not include emissions from organic carbon content of raw meal, which is estimated separately and added to the total CO_2 emissions from ETS data. The organic carbon adds up to about 2 % of the total emissions and hence ETS data accounts for about 98 % of the CO_2 emissions reported from cement production. There are currently also an outstanding issue on wether or not emissions from CKD, cement kiln dust, should be added to the total CO_2 emissions. According to representatives of the cement producer there are no longer any CKD emissions from the production process – but this issue is yet to be verified. Until then CKD emissions are also added according to data from 2004, but these are just a very minor part of the total CO_2 emissions.

Plants included in the ETS

All Swedish plants are included in the ETS.

Advantages and disadvantages with increased use of ETS data

ETS data can continuously be used without any disadvantages but adjustments for CO_2 emissions from organic content of raw meal and CKD might still be needed.

CRF 2A2, Lime production

Description

Process emissions from lime production account for about 1 % of total national GHG emissions and about 10 % of the process-related GHG emissions. Lime is produced at lime production facilities but also within the sugar industry and the paper and pulp industry. In total, about 30 plants are included in the inventory.

Data sources in submission 2008

Activity data on lime production are gathered through direct contacts with the industry association for lime producers and the major Swedish sugar producer. Emis-

sions are estimated based on activity data together with national standard emission factors. Hence ETS data is not used at all in the GHG inventory as regards emissions from lime production.

Plants included in the ETS

Most of the lime producers are included in the ETS but to which extent they report the data needed to estimate emissions from lime production is not known.

Advantages and disadvantages with increased use of ETS data

As most plants are part of the ETS, it would be possible to use ETS data for the GHG inventory in the future, if the data needed to estimate emissions from lime production are available in the ETS data. However, it would require quite a lot of resources to update the time-series from 1990 to be in line with data reported to the ETS, unless the ETS data and the data reported by industry associations match.

CRF 2A3, Limestone and dolomite use

Description

Process emissions from limestone and dolomite use account for about 0,2 % of the total national GHG emissions and about 2 % of the process-related GHG emissions. Limestone and dolomite reported under CRF 2A3 are used in the production of iron pellets, glass, mineral wool and ceramics and within the energy production industry.

Data sources in submission 2008

Activity data from ETS was used for about 50 % of the about 20-25 plants included in the national inventory. The inexact number of plants included is due to the fact that CO_2 emissions from glassworks are estimated using a constant value covering all glassworks. Other major sources for activity data are the companies' environmental reports and direct contacts with the companies. National standard emission factors have been used together with the assembled activity data.

Plants included in the ETS

In 2005, plants included in the ETS accounted for more than 90 % of the emissions within this category. The emissions are estimated from ETS activity data, which means that the actual CO_2 emissions are not taken from ETS data.

Advantages and disadvantages with increased use of ETS data

As many plants are part of the ETS, it would be possible to use CO_2 emissions provided by ETS data for the GHG inventory in the future. This is depending on whether or not the ETS includes specific data on emissions from limestone and dolomite use in a way that it can be transferred to the current estimations model. However, a shift during the current commitment period might require an update of

the whole time series from 1990 since the national EF for lime is somewhat lower than the EF used by the facilities reporting to the ETS.

CRF 2A4, Soda ash production and use

Description

Process emissions from soda ash use (production does not occur in Sweden) account for about 0,04 % of total national GHG emissions and about 0,5 % of the process-related GHG emissions. Soda ash use reported under CRF 2A4 are used in the production glass, mineral wool, snuff and chemicals.

Data sources in submission 2008

Activity data on soda ash use were gathered from ETS (3 companies) and through companies' environmental reports and direct contacts with the remaining 10 reporting organizations. Default emission factors are used to calculate the emissions from these activity data.

Plants included in the ETS

Three plants included in the ETS are currently reporting emissions and activity data from soda ash use. These account for almost all (99 %) of the CO_2 emissions reported from CRF 2A4.

Advantages and disadvantages with increased use of ETS data

Emission data from ETS could be used for the plants included in the ETS without any major disadvantages. The only disadvantage might be the possible future remarks from reviewers on possible time-series gaps between pre- and post-ETS data.

CRF 2A7, Other mineral products

Description

Process emissions reported under CRF 2A7 account for about 0,01 % of total national GHG emissions and about 0,1 % of the process related GHG emissions. Emissions currently reported under CRF 2A7 originate from LECA production.

Data sources in submission 2008

ETS emissions data are used for the one company reporting emissions in CRF 2A7.

Plants included in the ETS

All plants included in the national inventory are included in the ETS.

Advantages and disadvantages with increased use of ETS data

ETS emissions data can continuously be used without disadvantages.

CRF 2B4, Carbide production

Description

Process emissions from carbide production account for about 0,07 % of total national GHG emissions and about 0,8 % of the process related GHG emissions.

Data sources in submission 2008

Activity data are retrieved from the one carbide producing plant's environmental report. Emissions are estimated using a national emission factor.

Plants included in the ETS

The carbide producing plant does not report process emissions to the ETS.

Advantages and disadvantages with increased use of ETS data

ETS data is not available.

CRF 2C1, Iron and Steel production

Description

Process emissions from iron and steel production account for about 2,4 % of total national GHG emissions and about 26 % of the process related GHG emissions. Process emissions from iron and steel production are reported for 11 plants in the national inventory.

Data sources in submission 2008

Emissions and activity data are assembled from ETS and through direct contacts with plant representatives.

ETS emissions data was used for seven plants accounting for about 10 % of the total emissions from iron and steel production. For two of the remaining plants emissions data have been assembled through contacts with plant representatives, and for the last two plants emissions have been estimated based on data on blast furnace gas consumption from the Swedish energy statistics.

Plants included in the ETS

All plants included in the national inventory are included in the ETS. However, ETS data are only used where emissions reported to the ETS are comparable to those estimated by SMED prior to the introduction of ETS data.

Advantages and disadvantages with increased use of ETS data

It would be an advantage to use ETS data for all plants within CRF 2C1, since data of high quality is readily available. However, a major disadvantage is that it will not be possible to fully implement ETS data without causing time-series gaps for

those plant where ETS data are currently not used . Adjusting the emissions estimates for the years prior to ETS data to be in line with ETS emissions data would demand quite a lot of resources.

CRF 2C2, Ferroalloys production

Description

Process emissions from ferroalloys production account for about 0,3 % of the total national GHG emissions and about 4 % of the process related GHG emissions. Process emissions from ferroalloys production are reported by one plant in the national inventory.

Data sources in submission 2008

Emissions data are retrieved from the ferroalloys producing plant's environmental report.

Plants included in the ETS

The ferroalloys producing plant does not report process emissions to the ETS.

Advantages and disadvantages with increased use of ETS data

ETS data is not available.

CRF 2C3, Aluminium production

Description

Process emissions from aluminium production account for about 0,2 % of the total national GHG emissions and about 2 % of the process related GHG emissions. Process emissions from aluminium production are reported by one plant in the national inventory.

Data sources in submission 2008

Emissions data are retrieved from the aluminium producing plant's environmental report.

Plants included in the ETS

The aluminium producing plant does not report process emissions to the ETS.

Advantages and disadvantages with increased use of ETS data

ETS data is not available.

CRF 2C5, Other metal production

Description

Process emissions from other metal production account for about 0,2 % of the total national GHG emissions and about 2,5 % of the process related GHG emissions. Two plants report process emissions from other metal production in the national inventory.

Data sources in submission 2008

Emissions data are retrieved from the plant's environmental reports and from ETS activity data.

Plants included in the ETS

One plant is included in the ETS.

Advantages and disadvantages with increased use of ETS data

ETS emissions data could be used for the one plant included in the ETS since data of high quality for that plant is readily available. However, if the emissions reported by this company were to be applied in the national inventory the whole time-series would possibly need to be recalculated to avoid a time-series gap. This would require some extra work.

CRF 2, Findings from earlier studies

In Lidén & Nyström, 2004, the possibility of using ETS data for process emissions based on the result of the preparatory trading survey was investigated. In this study, it was concluded that ETS data could preferably be used for process emissions from plants within the mineral industry, i.e. CRF 2A. For metal production, the conclusion was less straightforward. Due to certain deficiencies in the data reported in the trading survey from several plants and the fact that e.g. some aluminium producers were not included in the ETS, the possibilities of using ETS data for CRF 2B were considered smaller. However, ETS data was recommended as the source for emission data for the copper production in Rönnskärsverken.

The final conclusion from that study regarding process emissions was that ETS data would be the preferable data source, provided that both emissions and activity data are reported by the plants. Use of ETS data would imply consistency between GHG inventory data and data reported to the ETS, and moreover it would lessen the respondent burden for the plants, and possibly also lead to a decreased work-load for SMED.[27]

[27] Lidén & Nyström, 2004.

CRF 2, Conclusion

For process emissions, ETS data is already an important data source in the GHG inventory. However, the ETS data used in the GHG inventory are often activity data and not actual emissions data.

As the process-related emissions are calculated in a less automatized way than the energy-related emissions, using activity data from the ETS instead of some other data sources would be fully feasible from a technical viewpoint. One problem is that ETS data sometimes does not follow the structure of the process emissions estimation model. Other activity data than those applied for the GHG inventory is presented in the ETS data and emissions are not in line with those reported in the GHG inventory. Another problem is that applying ETS data would probably require a lot of time-series recalculations back to 1990, due to the fact that the emissions factors used estimating ETS data do not exactly match the national emission factors currently used in the GHG inventory. However, it would be recommendable to make a one-time effort to adapt the current national inventory estimations to facilitate the use of ETS emissions data to the largest extent possible. This would improve both the quality and the future efficiency of the GHG inventory estimates as well as the comparability between the national inventory and ETS data.

Measures needed to separate the trading sector from the non-trading sector in the QS dataset.

In the QS, the so called Cfar-number is used for identification of specific plants. In the ETS, the Cfar-numbers are not used, but every plant is given a unique identification number. To separate the trading plants from the non trading ones in the QS, all plants in the ETS have to be identified manually in the sampling frame used for the QS in order to get the Cfar-numbers for all trading plants. Once this is done, the trading plants can easily be removed from the QS-dataset and there is no need to repeat the manual procedure each year. It must, however, be revised prior to every new trading period, as which plants that are included in the ETS might change. Another issue is the sample enumeration in the QS, which must be investigated in more detail if ETS data would be used more extensively.

Additional costs following more extensive use of ETS data

The costs that would result from increased use of ETS data have been thoroughly investigated by Gustafsson, Lidén & Nyström 2005. This chapter is an updated version of the cost analysis in that report, which is valid for CRF 1A1 and 1A2.[28]

[28] Gustafsson, Lidén & Nyström, 2005.

A major part of the costs is related to CRF 1A1a. In order to get complete emission statistics for energy-related emissions, the energy statistics must be used as a base, because data is needed also for those plants that are not included in the ETS. This is the case regardless of if ETS data is used or not, which means that increased use of ETS data would increase the total amount of work needed for the calculations. It should be noted that the following estimations of costs are very approximate, and applies to a situation where ETS data is used to the greatest extent possible for every sector. If only one or a few sectors would be affected, the costs would be considerably lower.

Identification of plants in the QS in order to remove plants that are included in the ETS

To identify the plants which are included in the ETS, identification numbers called Cfarnr are needed. These are, however, not included in the ETS data. If the Swedish EPA cannot provide Cfarnr for the trading plants, the matching has to be done manually, which would imply an extra cost of approx. **SEK 10 000** and apart from this increase the risk of erroneous matching.

Every local unit within ISIC 10-37 has a unique Cfarnr, and in these sectors every plant is a unique local unit and thus the Cfarnr can be used to identify the plant in the QS. In ISIC 40, which includes most of the plants with emissions reported in CRF 1A1a, one local unit can include several plants, and thus Cfarnr can not be used to identify the plants within this sector.

The yearly cost for this identification-removal process is proportional to the number of plants. If all emissions within CRF 1 from plants included in the ETS would be calculated from ETS data, the cost would be approximately **SEK 100 000 per year.** As an example, it can be mentioned that about 30 % of the plants in the GHG inventory report emissions within CRF 1A1a, the sector where the identification is most difficult. Thus, the cost depends to a great extent on for which sectors, and for how many plants, ETS data will be used.

Adjustments for plants included in the ETS but not in the QS sample

Most likely, a number of plants included in the ETS cannot be identified in the QS, mostly because they are not included in the QS sample. Provided that the upward sample adjustment in the QS has the form of an additional post per sector, ETS data for plants not included in the QS can be subtracted from the corresponding additional posts. This implies manual work, including manual calculations of corrected fuel amounts for all affected ETS data and additional posts, respectively. The time and cost is directly proportional to the number of ETS observations affected, and hence it is difficult to estimate. A very coarse estimate if ETS data would be used to the greatest possible extent is **SEK 30 000 per year**.

Conversion of fuel units

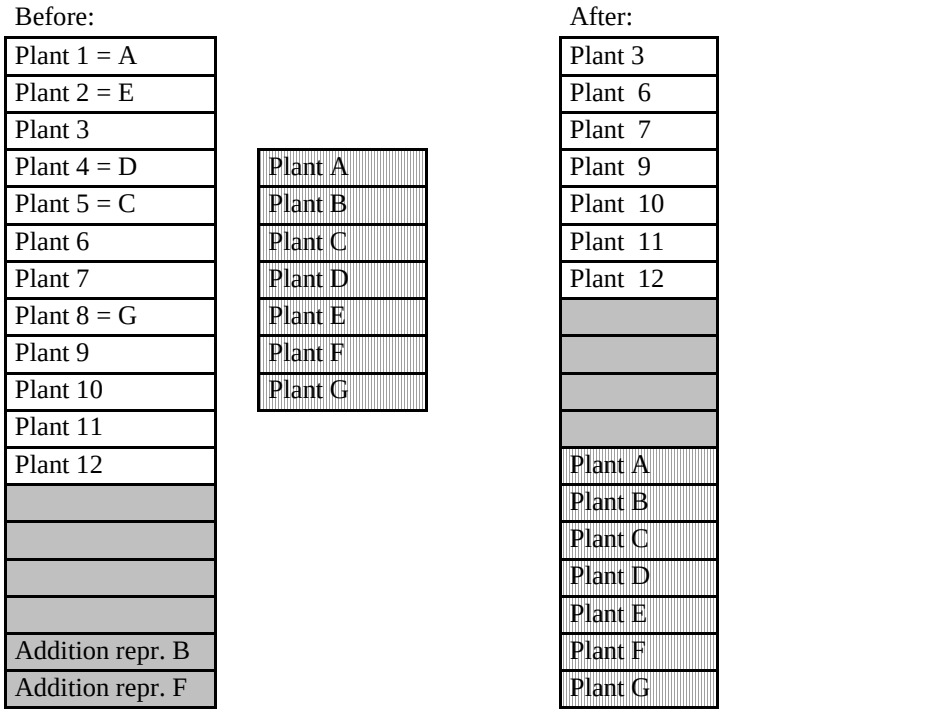
The forms for reporting to the ETS are constructed in a way that gives the respondent the opportunity to choose between several reporting units. This applies to activity data, where the respondent is free to choose between tonnes and cubic metres, thermal values, where there are as much as five alternative units to choose from, and emission factors, where the alternatives are tonnes CO_2 per m^3, per TJ or per tonne of fuel. This multitude of different units used leads to a time consuming extra work with conversion to standard units, which to a large extent has to be done manually. The approximate cost for this work has been estimated to about SEK **25 000 per year**.

Adding of ETS data to files based on QS data

Once the QS data has been cleared from double counting etc. mentioned above, and the ETS data has been converted to suitable units, the respective data files can be merged. This could be done in a relatively automatized way by means of SAS programming. The cost would be approximately **SEK 10 000 per year**.

The four operations mentioned above are summarized in the following figure taken from Gustafsson, Lidén & Nyström 2005:

Figure 1: Replacement of QS data with ETS data



White: Results from the QS survey

Grey: QS enumeration compensating for plants not included in the survey

Striped: ETS data

Quality assurance

The work operations following after those mentioned above are the same as if ETS data would not have been used. However, the quality check must be substantially extended to enable quality assurance of the extensive manual work. The cost of this work is very difficult to estimate, but a coarse estimation is about **SEK 50 000 per year**.

In summary, the extra cost for using ETS data to the greatest possible extent within all affected sub sectors of CRF 1, i.e. energy related emissions from stationary combustion, would be about **SEK 225 000 per year** if Cfarnr cannot be provided by the Swedish EPA, and otherwise about SEK 215 000. The majority of these costs would be caused by the work needed for CRF 1A1a. If ETS data would be used for only one or a few of the sectors, the cost would, of course, be lower. For CRF 2, there would be a one time cost for recalculation of earlier years, but once this is done the extensive use of ETS data would be cost effective and hence there would be no yearly extra costs.

Discussion and conclusions

Generally speaking, the greatest benefits from increased use of ETS data would be achieved for those CRF sectors where the QS data is of questionable quality and/or the emissions are large and thus have considerable effects on the national totals. The conditions are, of course, different for different sectors, and this has been discussed in previous chapters.

An obvious advantage with extensive use of ETS data is that the consistency between the GHG inventory and the data reported to ETS will improve. To achieve perfect consistence, ETS data would have to be used in the GHG inventory for all plants included in the ETS. As both the QS and ETS data are bottom up calculations, i.e. a summation of plant specific data from individual plants, the time series would be consistent on an aggregate level if the data source is exchanged between years. Of course, the time series would not be consistent on plant level, but that is still not always the case as some of the plants included in the QS sample are not the same every year.[29]

In sectors where many of the plants are included in the ETS, but a considerable amount of the emissions originate from non-trading plants, extensive use of ETS data would be very time consuming and involve a considerable amount of manual

[29] Gustafsson, Lidén & Nyström, 2005.

work, which increases the risk for errors. For sectors where this is the case, it could also be difficult to choose between adjusted and non-adjusted QS data.
A general argument against more extensive use of ETS data is the additional work and extra costs, which should, of course, be viewed in relation to the benefits. In Lidén and Nyström 2004, it was argued that the quality improvement would not be large enough to motivate the increased cost:

> *"In general, the energy statistics is of sufficiently high quality. If the industrial statistics, as proposed, will become a total survey every year, the quality will be further improved as the industrial statistics serves as a sampling frame for the QS. Emission data is not reported on plant level in the GHG Inventory, but aggregated for quite coarsely defined sectors. Thus the benefit of using ETS data in the GHG Inventory is questionable, and adding and subtracting observations manually from the datasets on which the emission calculations are based would imply a considerable amount of extra work without any significant quality improvement. This would not be cost effective and hence not Good Practice according to the IPCC Guidelines."*[30]

It should be noted that the conclusion quoted above applies only to the energy emissions within CRF 1A1 and 1A2. As discussed in earlier chapters, the use of ETS data for process emissions, i.e. within CRF 2, is likely to be more cost effective once an initial recalculation of the times series based on ETS data has been made.

Conclusions

This investigation has shown that the conditions and possibilities to use ETS data more extensively than today are different for different sectors. Those categories where it would be most beneficial to use ETS data to the greatest possible extent are 1A1b – oil refineries, 1A2d – pulp, paper and print, and CRF 2 - process-related emissions.

In CRF 1A1b, ETS data is already used quite extensively, and all major contributors to the emissions of fossil CO_2 are part of the ETS. The number of plants is small, and hence the extra work will be minimal. As the number of plants is very small, plant specific emission factors could be used without extra costs.

In CRF 1A2d, earlier studies have shown that ETS data is to be regarded as more accurate than QS data, and in addition to this the trading plants account for more than 95 % of the emissions of fossil CO_2 within CRF1A2d.

[30] Lidén & Nyström, 2004.

In CRF 1A1a, 1A1c, 1A2a and 1A2f, increased use of ETS data cannot be generally recommended (exceptions for individual plants were discussed in the respective sector specific chapters). In CRF 1A1c, manufacture of solid fuels and other energy industries, and CRF 1A2a, Iron and steel production, plants accounting for a very large part of the emissions report to the ETS in a way that makes it impossible to allocate the emissions to the correct processes and fuels, and thus it is not possible to use ETS data for these emissions.

In CRF 2, ETS data could preferably be used to the largest extent possible, although it requires a one-time effort to adapt the current national inventory estimations. This would improve both the quality and the future efficiency of the GHG inventory estimates as well as the consistency between the national inventory and ETS data.

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