Aarhus University Emissions Inventory 2020

Academic note from DCE - National Center for Environment and Energy

Date: 25. Jan 2022 | **XX**

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Academic note from DCE - National Center for Environment and Energy

Category:	Academic Advisory Report
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Cite as:	Stridsland, T.D. Sanderson, H., Winter, M., Mikkelsen, M.J. & Nielsen, O.-K. 2022. Aarhus Universitets klimaregnskab 2020. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 39 s. – Fagligt notat nr. 2022|xx https://dce.au.dk/fileadmin/dce.au.dk/Udgivelser/Notatet_2022/N2022_xx.pdf
	Reproduction is authorized provided proper citation
Photocover:	Aarhus University and Colorbox
Number of pages:	399

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Executive Summary

Aarhus University continues with the internal greenhouse gas (GHG) inventory for 2020, under an updated methodology. The core elements of the method remain the same, allowing for comparisons between 2018 and 2019, however the introduction of a spend-based method of assessment means that Aarhus University (AU) is able to assign emissions to 84% of spending within AU purchased goods. Another change is that the inventory is presented in English, with the intention of providing access to a broader audience. The data presented here were collected through AU sectors and analysed by the Danish Center for Environment and Energy (DCE). The inventory adopts an organisational methodology from the GHG protocol, which operates through a bottom-up process based approach (PB) by factoring activity data with an emission factor (EF) to produce a final emission in tons of CO_2 equivalent (t CO_2e).

The new addition to this year's method is the adoption of a spend based (SB) environmentally extended input-output model (EEIO) which allocates emissions according to economic spending within a given sector. The benefits of adding this method is both to estimate emissions associated with purchased services, a component that the bottom-up process isn't well suited to account for, as well as providing a screening assessment of an otherwise insurmountable task of estimating emissions for university purchasing. Adopting this method also includes the inherent compromise on accuracy, as the SB method presents industry average results, rather than the specific results that come with a PB method. It is better to have an average measurement than no measurement at all, and given the university data we have access to, the benefits of the coverage outweigh the inaccuracies. This distribution of PB and SB methods will change, as the university activity data resolution increases for the coming reports. The emission factors for the PB and SB methods used in this report are collected from various academic and public sources, and are expected to change from year to year. Ultimately, the PB method is characterized by greater scientific and actionable detail and the SB method is characterized by greater completeness speed and ease but lacks in scientific detail and actionability.

The inventory follows the GHG protocol's guidelines for reporting scope 1, 2, and 3, which include direct emissions such as transport and on-site emissions, and agricultural emissions, as well as indirect emissions associated with the university's operations. The indirect scope 3 emissions included in this assessment under the PB method includes water consumption, upstream fuel and energy emissions, business travel and investments. A SB assessment method was applied to areas previously not included in the GHG inventory, namely procurement, whereby all university spending within services, products and business travel are documented.

The total emissions under the PB method is **20,445.9 t CO_2e**, which is down 44% from 2019 and a great part of the reduction can be attributed to the drastic decrease in university business travel due to COVID-19. Overall reductions are seen across all the scopes, associated with reduced activity data. Scope 1 emissions are **6,082.0 t CO_2e**, down 10% from 2019 and scope 2 emissions are **8,085.8 t CO_2e**, down 11% from 2019. Scope 3 shows the largest emission reductions when comparing the same parameters measured (excluding investments and Well to Tank – emissions from extraction and production of the fuel to finished fuel product) in 2019 with 91% reductions at **1,026.0 t CO_2e**.

Introducing the SB method begins a new chapter in the AU GHG inventory. In the absence of individual product based data, we use spend based data, despite this being less accurate. This is an effort to avoid paralysis by analysis, and the results presented here are done so using the best available methods. Comparing the accounted SB emissions to the amounts spent in each procurement category, roughly 84% of the spending in purchased goods and services is converted to emissions. In addition to procurement, the same SB method is applied to business travel, and between the DCE flight emissions model and the SB method, 95% of spending within business travel is converted to emissions. Combining both the PB and SB methods result in an overall total of **65,237.0 t CO_2e**, of which scope 1 emissions account for **6,082.0 t CO_2e**, scope 2 emissions for **8,085.8 t CO_2e**, and scope 3 emissions for **51,069.2 t CO_2e**.

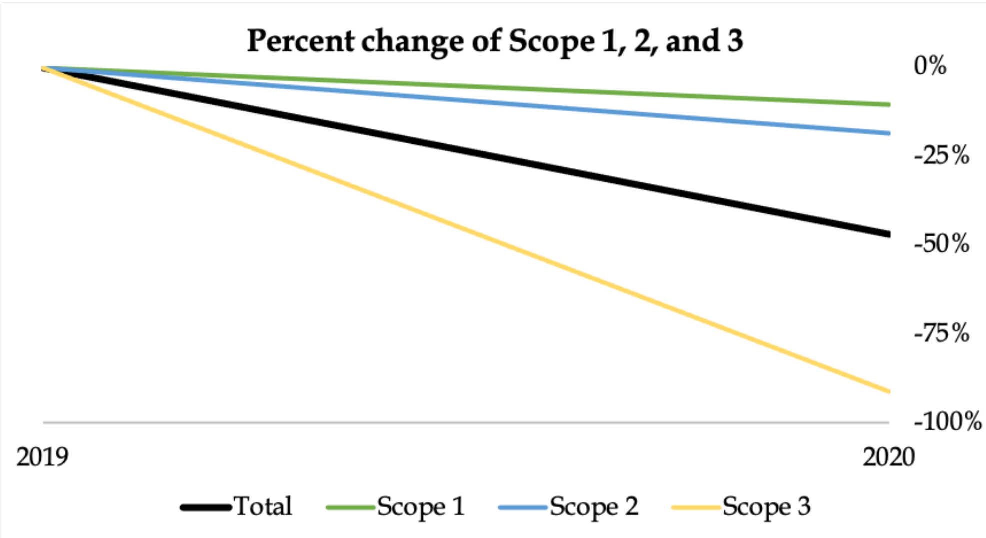
The t CO_2e per person-year across employees results in: **8.15 (t CO_2e/employee-year**); **2.46 (t CO_2e/student-year**), and combined **1.89 (t CO_2e/total-AU-year**).

Visual Summary

The visual summary is shown in three parts. First, the PB results are shown in relation to the 2019 emissions, using the same parameters as previously measured. Second, the progression from 2018 to 2020 is shown, using the same parameters as previously measured, and finally the combined SB and PB method is presented.

Process Based Comparison 2019 - 2020

The following figures show the percentage development of emissions from 2019 to 2020. The right axis indicates the positive or negative percent change in 2020 emissions and activity. Note: Right axis minimums are at -100% for all graphs that include air travel emissions (*Top* and *Bottom Right*).



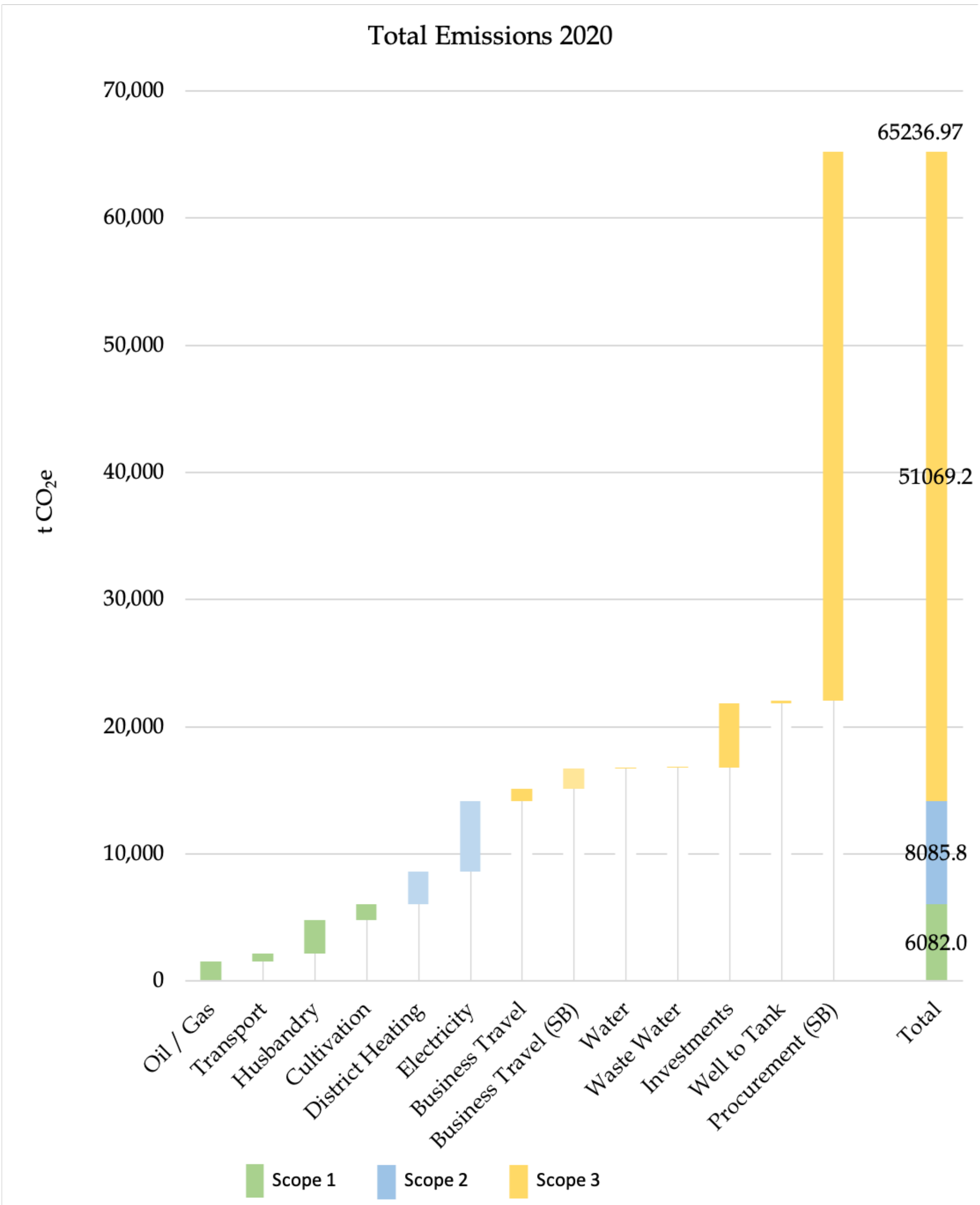
Process Based Comparison 2018 – 2020

The results of the 2020 Aarhus University greenhouse gas inventory in relation to 2018 and 2019 data activity and emissions data are shown in the figures below. They show the percentage development over time. The right axis indicates the positive or negative percent change in emissions and activity. Note: Scope 1 Transport activity starts in 2019 where comparable data were gathered, however, the emissions data are still relevant. Note: Right axis minimums are at -100% for all graphs that include air travel emissions (*Top* and *Bottom Right on next page*).

Top: Total emissions summary tracked along scopes 1, 2 and 3. *Top Left*: Scope 1 transport emissions and activity data – Note that activity data is not able to be traced back to 2018. *Top Center*: Scope 1 on-site heat generation emissions and activity data. *Top Right*: Scope 1 animal husbandry activity and emissions data. *Middle Left*: Scope 1 cultivated agricultural activity and emissions data. *Middle Center*: Scope 2 electricity consumption and emissions data. *Middle Right*: Scope 2 district heating emissions and consumption data. *Bottom Left*: Scope 3 water consumption activity and emissions data. *Bottom Center*: Scope 3 wastewater activity and emissions data. *Bottom Right*: Scope 3 flight emissions and activity data.

Combined Process Based and Spend Based Results

The effects on Aarhus University emissions by introducing the SB method is shown in the figure below, where SB categories are indicated. Each category is shown and colour coded according to scopes. The introduction of the SB method means that for the first time, almost 84% of AU purchased goods and services (thematic categories) are accounted for and converted to emissions.



1. Introduction

Aarhus University (AU) requested a greenhouse gas (GHG) inventory for 2020. The data presented here was collected through various AU sectors, including the university finance department. The data is presented in this report and verified by DCE (https://dce.au.dk/) -The National Center for Environment and Energy – who among other things produces the national emission inventory for Denmark. The activity data is converted using emission factors (EF) and presented in tons of CO_2 equivalents (t CO_2e).

AU started calculating their emissions in 2018, and the results in this report are held up to these baseline emissions in the areas where they are comparable. For this report, we employ the GHG Protocol methodology of organisational emissions allocation, which is a globally adopted and recognised method. The GHG protocol describes emissions across three scopes, whereof scope 1 is direct emissions, scope 2 is indirect emissions associated with purchased energy, and scope 3 is indirect emissions, and can be divided out into 15 sub-categories under scope 3 (figure 1). This is the structure used in this report, as there are clear guidelines on how each category should be determined.

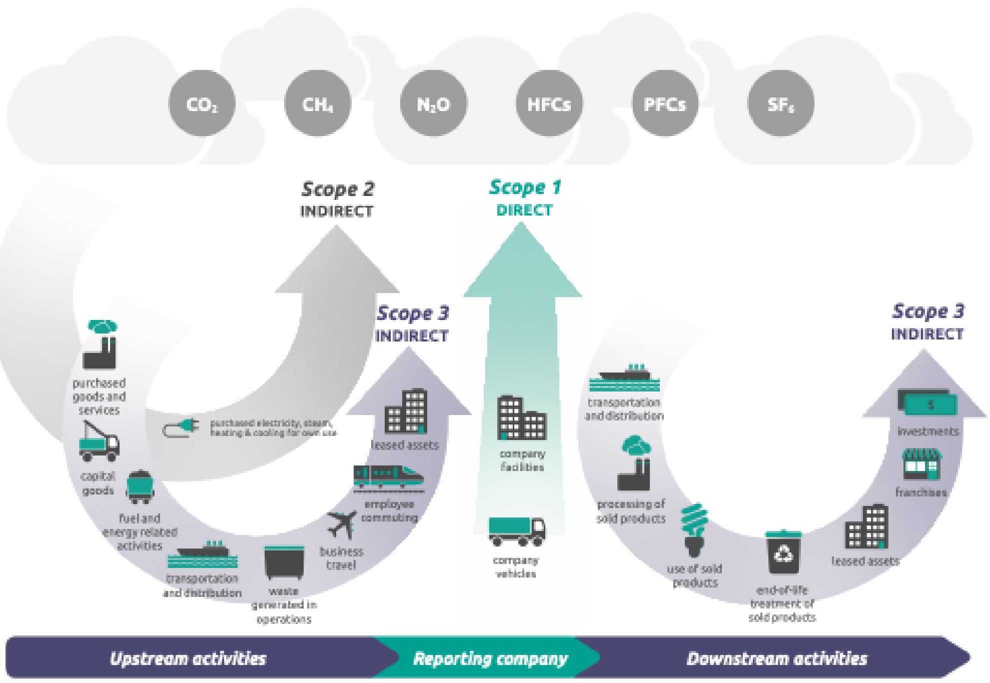


Figure 1. *Schematic from the Greenhouse Gas Protocol which describes how an organisations emissions are allocated. Scope 3 categories are numbered along the upstream and downstream arrows, starting at the left (Bhatia et al., 2011)*

The GHG Protocol is written to be broadly applied to many different kinds of organisations, and many of these guidelines are interpreted into sector specific guidance documents. The GHG Protocol offers guidance on both the width of the emissions inventory (18 categories across 3 scopes) as well as guidance on the depth of each category (to what detail and how to find the representative data) (Bhatia et al., 2011).

The protocol also suggests methods for calculating the emissions, according to the available data and size of organisation considered. The assessment continuum (figure 2) describes the methods available and the scale at which they produce optimal results based on time and resources. On the macro scale, environmentally extended input-output (EEIO) models based on global supply use tables are optimal. These models utilize economic spending and thereby can estimate emissions using a spend based approach (SB). On the opposite side of the spectrum are process based approaches (PB) which are well suited for products. These are defined by the inputs and outputs throughout the life cycle of product, and often presented in a life cycle assessment (LCA).

The data hierarchy describes the most accurate data being activity data in a per unit form, such as km's transported, liters of fuel, kg of wheat, etc. The emission factors used with these kinds of data are based on LCA's and follow the PB method, such as t CO_2e per km driven. The data hierarchy spans down to the least accurate form, the SB approach. The SB approach is described as the least accurate as the emission factors used in a spend based method are generated from industry averages and therefore should be used as indicator for further investigation.

But where does an organisation like Aarhus University fit? Adopting both methods in a hybrid setting allows for an efficient overview using the comprehensive SB approach for areas where detailed activity data, best suited for the PB method are not available. This is the approach we have taken in the 2020 GHG inventory for AU. This also means that new emission sources are being considered, which tells a new story compared to the ones in previous years. However, GHG inventories, as a rule of thumb, are living documents which evolve with the understanding of data collection, and method development. Asking the question "what makes an environmentally just GHG inventory?" sets the foundation for future AU GHG inventories. As the emission inventories evolve, more emission sources will be considered, resulting in an increasingly just GHG inventory.

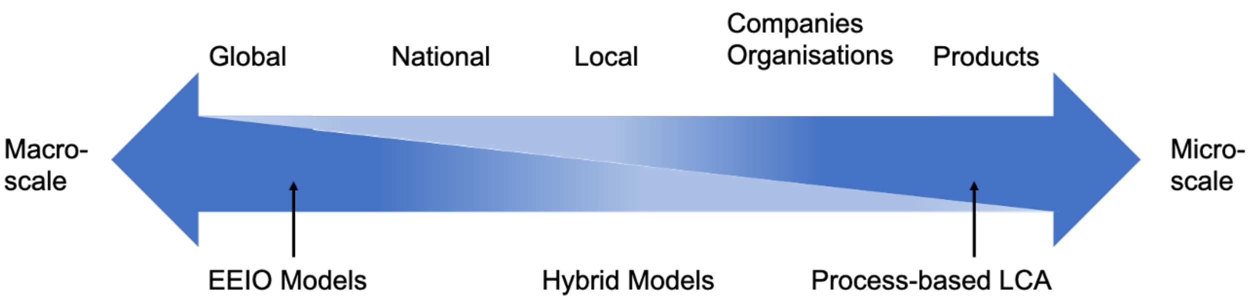


***Figure 2**. Emission assessment continuum. Adapted from (Peters, 2010)*

2. Background and Methods

The inventory follows the GHG Protocol's guidelines for reporting Scope 1, 2 and 3, which include direct emissions such as transport and on-site emissions from gas, oil usage, and agriculture, as well as indirect emissions from purchased utilities. Additionally, specific Scope 3 emissions, which are embedded in the value-chain, are included in the inventory. This report follows the structure presented by the GHG Protocol, with a new section for each category that includes results and discussions. The Scope 3 emissions that we included using the PB method were based on easily accessible data and include water usage and disposal, upstream fuel emissions, and business travel. Additionally, a SB method is introduced in this year's report, which allows for a comprehensive estimation of emissions from purchased goods and services, as well as economic activities within business travel.

Process Based Method Description

All the parameters defining the 2018 inventory are included in the 2020 inventory, allowing for meaningful comparisons across those parameters. These parameters, namely scope 1 and 2 (on-site heating, agriculture, AU transport and purchased energy) follow the PB approach and are defined by emission factors provided by the emissions group at DCE, who also supply the nationally determined contributions to the United Nations Framework Convention on Climate Change (UNFCCC). In addition to the 2018 parameters, a PB assessment of the upstream embedded emissions of fuel consumption (well to tank emissions) and a PB assessment of the university investments is included this year.

Spend Based Method Description

The nature of emission inventories is that they evolve to stay relevant. The introduction of a SB method in 2020 is a vital component of increased width of the 2020 analysis. The EEIO model behind the SB method used in this analysis is the EXIOBASE model, developed through Aalborg University. This model is rooted in global supply use tables, and consider global economic exchanges. By environmentally extending these economic inputs and outputs, emission factors are generated according to spending within economic sectors, meaning that they are able to account for services rendered, something that PB cannot. This is important as university operations rely heavily on services, and not including them does not lend itself to a climate just inventory. These SB emission factors have been accessed via a collaboration between Aalborg University and the Danish Business Authority, and applied to the most relevant spending categories of the AU financial accounts.

A limitation of the EEIO, and thereby the SB method, is that the resulting emissions are based on average emission factors meant to be representative of an entire sector's activity, meaning that they are best suited as a screening tool to point out hot spots for further PB investigations. In other words, if AU is presented with two similar products, the more expensive product represents higher emissions by the SB method, despite the product potentially lasting longer, and resulting in lower overall emissions. Another noteworthy limitation of this method is that the raw data used to create the model and identify emission factors are based on 2016 global transactions. Currently, an updated version of EXIOBASE is being developed, which will provide greater and more accurate results, although not being able to rival the accuracies found in the PB method. Until then however, we will use this method as the benefits outweigh the limitations.

The strength of the SB method comes from the ability to aggregate economic activity to categories, meaning that instead of finding individual product based emission factors for all the products that the university purchases, the economic spend amounts can be used as activity data. According to the GHG Protocol scope 3 categories, this proves especially useful in categories 3,1 – purchased goods and services, and 3,2 – capital goods. The difference between categories 3,1 and 3,2 is the timescale of the products, for example, pipette tips and gas for research is category 3,1, which are consumed within an economic year, while research purchased apparatus and vehicles are category 3,2, as they are used beyond the economic year. Many of the AU finance category names suggest that both category 3,1 and 3,2 were relevant, and the data prevented discernible differentiation between the two. Therefore category 3,1 and 3,2 were combined into "Procurement". All the AU finance categories were split into four themes (1) Purchased goods, (2) Purchased services, (3) Business travel, and (4) non-goods, based on information received from the AU finances department.

AU finance categories that were allocated to the "non-goods" category were not considered as they did not refer to a product or service, and therefore a minimal emissions contribution. These included "internal settlements" (intern afregning), "collaboration agreements" (samarbejdsaftaler), and "associations, organizations and grants" (Foreninger, organisationer og tilskud).

Generally, emissions closely follow kroners (DKK) and kilos, and for this inventory, given the available activity data, we adopt the economic allocation approach. AU spending data was supplied by the university accounting department, and was treated in the following method:

1. All AU finance categories were split into four thematic categories (1) Purchased goods, (2) Purchased services, (3) Business travel, and (4) non-goods.

2. Each thematic category was sorted according to total money spent within each.

3. AU finance categories already accounted for in the PB method were removed.

4. The remaining AU spending categories were best matched with EXIOBASE emission factors.

5. Coverage percent indicators were determined based on how much of the overall spend each thematic category represented.

6. Uncategorized categories within each thematic category were grouped and applied an average of EXIOBASE emission factors.

7. Total SB emissions were summed for an overall emission estimate and compiled with the PB method results.

It is important to note, that since most of the financial categories from the "non-goods" category are combined responsible for over 50% of the total university finances, the percentage in relation to overall finances presents a skewed picture considering the goal of this report. Most of the finances with little to no emission impact reduce the actual fraction each SB and PB category contributes.

3. Results and Discussion

This section will describe the results of the PB, SB and the combined hybrid method, across scope 1, 2, and the 15 categories of scope 3. First the PB results are presented and compared to 2018 and 2019 data, followed by presentation and discussion of the SB results.

Process Based Approach Overview

The total PB emissions for AU in 2020 were **2,0445.9 t CO_2e**, with the largest single contributor being the electricity consumption. Scope 1 emissions were **6,082.0 t CO_2e**, and are comprised of on-site oil and gas consumption, AU related vehicle activity, and agricultural emissions. It should be noted that in previous years, agricultural emissions were allocated to Scope 3, while this year, they are in Scope 1. This change better aligns our method with the recommended methods outlined by the GHG Protocol. Scope 2 emissions were **8,085.8 t CO_2e**, coming from electricity and district heating activities. Scope 3 emissions were **6,278.1 t CO_2e**, and are comprised of air travel, well to tank emissions for AU consumed fuel, water consumption, waste water generation and emissions associated with AU investments. A summary of the emissions is presented in table 1.

The total emissions for 2020 are down 44% from 2019, whereof a large part of these reductions can be attributed to the impacts of COVID-19. In line with an updated AU climate strategy, which was adopted halfway through 2020, (Aarhus University, 2020b) emission reductions due to AU initiatives are expected, however they are also expected to be overshadowed by the 2020 impacts of COVID-19. Given the framework of this report, we are unable to identify the impact that university initiatives have had for the remainder of 2020.

Total emissions are shown in figure 3 below, and percent changes are shown in *section 2. The Visual Summary*. The individual scopes and respective subcategories are also shown in the visual summary, with both the activity data and emissions data displayed together. This is to put the 2020 data in a relative frame to 2018 and 2019 data. It is important to note that a significant portion of the 44% reduction is primarily a result of drastic decreases in air travel – one of AU's largest emission sources. In previous years, air travel has accounted for roughly 40% of AU's overall emissions, while only representing 5% of the total 2020 emissions.

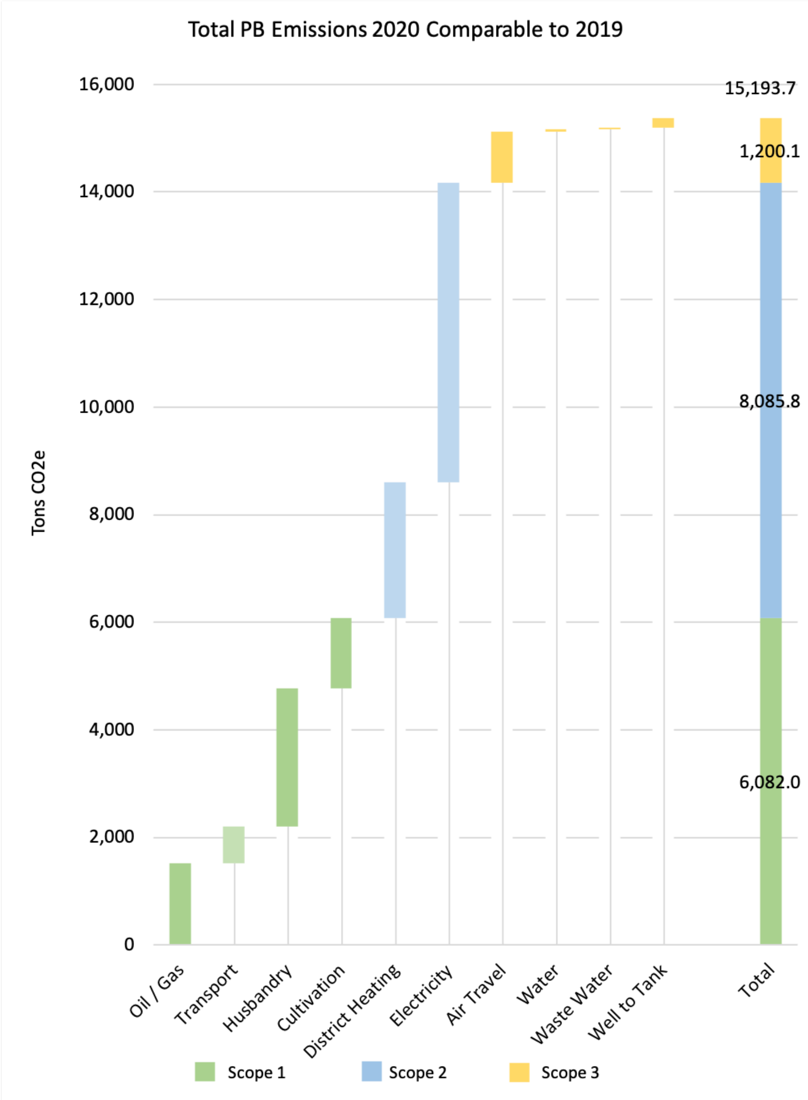


Figure 3. *Total Process Based emissions for 2020 across scopes 1, 2 and 3. Notable change compared to 2019 is the inclusion of well to tank emissions.*

Spend Based Approach Overview

The total SB emissions for AU in 2020 were **44,791.1 t CO_2e** with the largest contributor being within purchased goods (**23,704.0 t CO_2e**). The total SB emissions are determined from the thematic categories which provide spend based activity data, such as purchased services (**19,498.5 t CO_2e**), as well as thematic categories which have emissions accounted for by the SB and the PB method, such as business travel (**1,588.6 t CO_2e**). A summary of the emissions is presented in table 1.

Table 1. Results from the PB method, the SB method and the combined results

PB Method

Scope 1		**t CO_2e**
On-site Heating		1,520.4
Transport		674.7
Total Agriculture		3,886.9
Total Scope 1		6,082.0
Scope 2		**t CO_2e**
District Heating		2,526.2
Electricity		5,559.6
Total Scope 2		8,085.8
Scope 3		**t CO_2e**
1	Water Cons.	52.5
3	Well to Tank	174.1
6	Business Travel	949.8
5	Wastewater	23.6
15	Investments	5,078.0
Total Scope 3		6,278.1
Total PB Emissions		**20,445.9**

SB Method

Scope 3		**t CO_2e**
1+2	Purchased Goods	23,704.0
1+2	Purchased Services	19,498.5
6	Business Travel	1,588.6
Total Scope 3		44,791.1
Total SB Emissions		**44,791.1**

SB and PB Method

Scope 1		**t CO_2e**
On-site Heating		1,520.4
Transport		674.7
Total Agriculture		3,886.9
Total Scope 1		6,082.0
Scope 2		**t CO_2e**
District Heating		2,526.2
Electricity		5,559.6
Total Scope 2		8,085.8
Scope 3		**t CO_2e**
1+2	Procurement	43,255.0
3	Well to Tank	174.1
6	Business Travel	2,538.4
5	Wastewater	23.6
15	Investments	5,078.0
Total Scope 3		51,069.2
Total Emissions		**65,237.0**

Combined Approach Overview

Combining the two above approaches results in a total 2020 emissions of **65,237.0 t CO_2e**, with the most significant contributions being "procurement" under scope 3, category 1 and 2 at **43,255.0 t CO_2e**, which included both purchased goods and purchased services. The second largest contribution was electricity consumption at **5,559.6 t CO_2e**. The distribution of the results, as well as a comparison between the methods is presented in table 1, and visually below in figure 4.

This combined approach represents our most complete picture of the emissions coming from Aarhus University to date, with more categories planned to be included in future reports. As more categories are included, the total reported emissions will increase, as will also be the case for an increase in operations (for example - spending more on research equipment as budgets and projects increase). While increasing reported emissions from adding more categories can't be avoided, increases in emissions due to growth can be more accurately represented by dividing emissions by key figures. As with previous years, the total emissions here are reported in table 2 as t CO_2e per person-year across employees (**8.15 t CO_2e/employee-year**), students (**2.46 t CO_2e/employee-year**), and combined (**1.89 t CO_2e/employee-year**). Information on AU employees and students are found in the annual AU in numbers information report (Aarhus University, 2020a).

Table 2. Total emissions per person-year by employees, student, and combined

Group	t CO_2e
AU employees and researchers (8.005)	8.15
AU Students (26.475)	2.46
Combined (34.480)	1.89

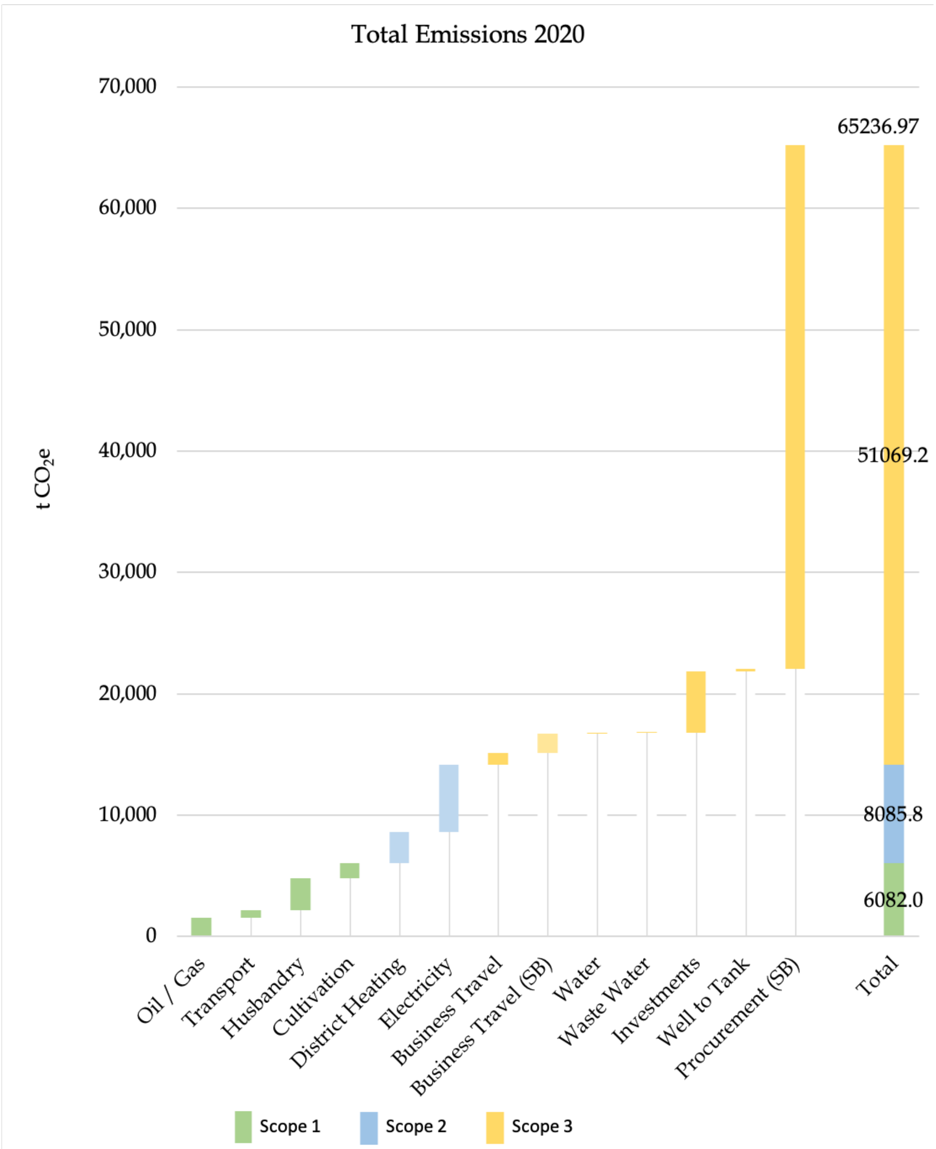


***Figure 4**. Distribution of emissions from the combined PB and SB methods, allocated and colour coded across scopes 1, 2, and 3.*

3.1 Scope 1

Scope 1 emissions are defined as emissions that come directly from company activity. Following the data hierarchy, AU has access to the most accurate forms of activity data, as well as nationally based emission factors from public organisations and reports, such as national inventories submitted to the UNFCCC and reports from the Danish Energy Agency. For scope 1, we use the best recommended by the GHG Protocol.

As there was no new SB method applied to scope 1, the results are able to be compared to last year's report. Scope 1 emissions are down 10% (t CO_{2e}) from 2019 emissions. Part of these reductions can be attributed to COVID-19 impacts on travel, exemplified by vehicle related travel emissions down by 19% compared to 2019. A slight increase in biogas is also present in scope 1, with 2% greater consumption than 2019. This consumption contributes zero emissions as per IPCC (Intergovernmental Panel on Climate Change) guidelines for biogenic emissions.

Different cruise requirements and research activities for the research vessel Aurora have resulted in a 46% increase in marine fuel emissions. The overall agricultural emissions report a 12% reduction of 2020 emissions when compared to 2019, despite an increase in animals. This can partially be attributed to changes in the cultivated hectare and animal portfolios between the years. The scope 1 emissions from on-site heating and transportation and activity data are presented below in table 3, and emissions from agriculture are presented in table 4, as well as visually in figure 5.

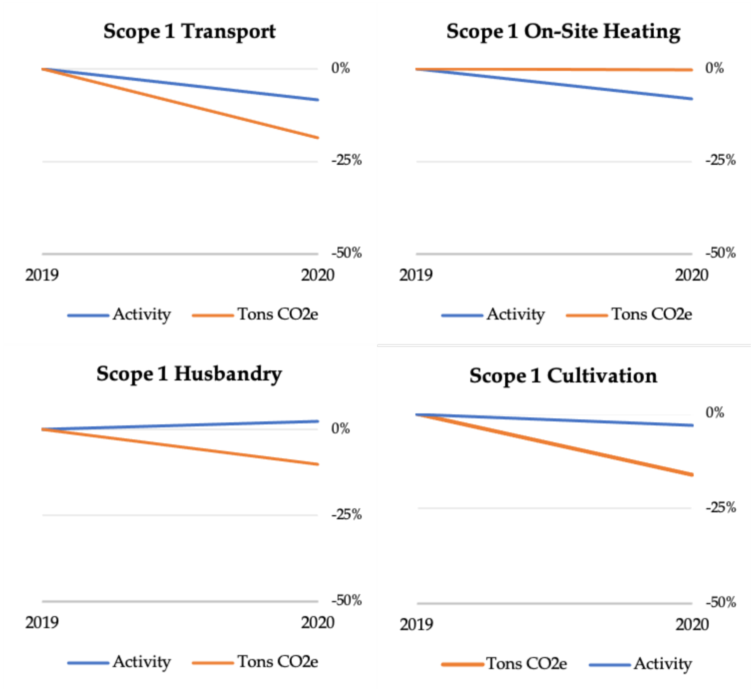


Figure 5. *Scope 1 emissions as compared to 2019*

Table 3. Summary of scope 1 emissions from on-site heating and AU transport

Source	Amount	Units	EF	Units	t CO_2e	Notes and Source
On-site Heating						
Gas	6,092	MWh	55.52	kg/GJ	1,486.8	Assuming it is the actual gas consumption and not heat production. CH_4 and N_2O contributions not included
Biogas	6,699	MWh	0	kg/M3	0	Cf. 2006 IPCC Guidelines, then the CO_2 emission factor is 0. CH_4 and N_2O contribution not included
Oil	126	MWh	74.1	kg/GJ	33.6	Assuming it is the actual oil consumption and not heat production. CH_4 and N_2O contributions not included
Wood Pellets	1,235	MWh	0	kg/kg	0	Cf. 2006 IPCC Guidelines, then the CO_2 emission factor is 0. CH_4 and N_2O contribution not included
On-site Heating	**14,152**			Total	**1,520.4**	
Transport						
Aurora (Research Vessel) (L diesel)	60,560	L Diesel	2.68	kg/l	162.3	Emission factors for marine engines using marine diesel, derived from DCE's ship emission model [1]
Cars (employee owned km driven, settled through RejsUd AU))	200,275	km	0.1477	kg/km	29.6	Weighted emission factors for petrol and diesel passenger cars derived from DCE's road traffic emission model [1]
Cars (external manual settlements in DK and abroad)	273,262	km	0.1477	kg/km	40.4	Weighted emission factors for petrol and diesel passenger cars derived from DCE's road traffic emission model [1]
Cars (fuel sales AU company cars, liters of petrol)	11,165	L Petrol	2.294	kg/l	25.6	Emission factors for petrol passenger cars derived from DCE's road traffic emission model [1]
Cars (fuel sales AU service cars, liters of diesel)	48,346	L Diesel	2.515	kg/l	121.6	Emission factors for diesel passenger cars derived from DCE's road traffic emission model [1]
Non road machines (fuel sales, liters of diesel)	108,013	L Diesel	2.693	kg/l	290.9	Emission factors for diesel-powered non-road machines derived from DCE's non-road emission model [1]
Non road machines (fuel sales, liters of petrol)	1,865	L Petrol	2.353	kg/l	4.4	Emission factors for petrol-powered non-road machines derived from DCE's non-road emission model [1]
Transport	**229,949**			Total	**674.7**	

[1] (Winther, 2018): Danish emission inventories for road transport and other mobile sources. Inventories until the year 2016. Aarhus University, DCE – Danish Centre for Environment and Energy, 127pp. Scientific Report from DCE – Danish Centre for Environment and Energy No. 277. http://dce2.au.dk/pub/SR277.pdf.

The agriculture department of the DCE emission group has refined the model used to estimate agricultural emissions. The resulting emissions using this more comprehensive model are presented below in table 4, and applied to 2018 and 2019, based on each year's activity data, and thereby allows for a comparison between years. Despite a 2% increase in animals, emissions dropped with 10% compared to 2019. A 3% drop in cultivated hectares, and a 16% reduction in emissions was seen in 2020 cultivated land.

Table 4. *Summary of emissions from agricultural practices*

Animal Husbandry	**t CO_2e**
Digestion - dairy cattle	1228
Digestion -other cattle	445
Digestion - pigs	49
Digestion -other animals	2
manure handling - dairy cattle	439
manure handling - other cattle	130
manure handling - pigs	192
manure handling - other animals	47
Indirect N_2O from barn and warehouse	48
Total Animal Husbandry	**2579.8**

Cultivated Land	**t CO_2e**
Commercial fertilizer	322
Other organic fertilizers	343
Grazing of animals	65
Crop residues	281
Cultivation of organic soils	70
Indirect N_2O (NH_3 and NOx emissions)	40
N leaching	185
Liming	0.019
Carbonated commercial fertilizer products	0.240
Total Cultivated Land	**1307.1**

3.2 Scope 2

Scope 2 is described as indirect emissions associated with purchased energy. As with scope 1, this report has access to unit based activity data, namely kWh of electricity consumption and MWh of heat consumption. These are matched with emission factors from the Danish Energy Agency and follow the GHG protocols best recommendations for determining the resulting emissions.

Scope 2 was also not in need of SB methods, and therefore the PB results are described in relation to 2019. Scope 2 emissions based on electricity and district heating are down 19% from 2019. Marginally fewer kWh heat (-2%) and electricity (-12%) were consumed this year. Despite the reductions in activity, heating emissions increased with 42%. This is due to AU's largest heat supplier, Aarhus Affaldvarme, publishing a 2020 emission factor roughly 60% higher than 2019. This is contrary to electricity emissions, which due to an increasingly greening energy mix resulted in 24% fewer electricity related emissions compared to 2019. Halfway through 2020, AU began purchasing green electricity certificates to contribute to the green transition, however these are not included in this report as the electricity used at the university is still reflective of the Danish national emission factor for 2020 (0.125 kg CO_2e / kWh). A complete summary of the emissions is described in table 5, as well as a visual comparison in figure 6.

Table 5. *Summary of Scope 2 activity data, emission factors and emissions*

Source	Amount	Units	EF	Units	t CO_2e	Notes and Source
Affaldvarme Aarhus	39,023.84	MWh	44.7	kg/MWh	1,744.4	EF is taken from Affaldvarme Aarhus website [1] and is based on the total CO_2 emissions and heat production.
HOFOR	2,655.88	MWh	49.9	kg/MWh	132.5	EC taken from HOFOR website [2]
Hashøj	1,992.94	MWh	17	kg/MWh	33.9	EC is based on a calculation of emissions based on fuel consumption, standard DCE emission factors and heat supply.*
Eniig	789.04	MWh	165	kg/MWh	130.2	EC is based on a calculation of emissions based on fuel consumption, standard DCE emission factors and heat supply.*
Rønde Fjernvarme	408.86	MWh	0	kg/MWh	0.0	Negligible - Based on straw and biomass. Cf. 2006 IPCC Guidelines, then the CO_2 emission factor is 0. CH_4 and N_2O contribution not included
Silkeborg Forsyning	847.72	MWh	85	kg/MWh	72.1	EC is based on a calculation of emissions based on fuel consumption, standard DCE emission factors and heat supply.*
Other (antaget Affaldvarme Aarhus)	3,650.00	MWh	44.7	kg/MWh	163.2	EF is taken from Affaldvarme Aarhus website [1] and is based on the total CO_2 emissions and heat production.

Roskilde	3,247.00	MWh	77	kg/MWh	250.0	Only Roskilde post numbers used in calculation. EC is based on a calculation of emissions based on fuel consumption, standard DCE emission factors and heat supply.*
Total	52,615.28			Total	2,526.2	
				Electricity		
Aggregated	44,476,784	kWh	0.125	kg/kWh	5,559.6	EF from Energinet.dk. CH_4 and N_2O contributions not included
Total Scope 2					**8,085.8**	

[1]https://varmeplanaarhus.dk/_layouts/15/xlviewer.aspx?id=/Shared%20Documents/KPI%20Dashboard%20C02-emission.xlsx [2] https://www.hofor.dk/baeredygtige-byer/beregn-co2/miljoedeklarationer/miljoedeklaration-for-fjernvarme/ * Data for fuel consumption and heat supply are from a confidential data set.

As is shown in figure 6, despite an overall decrease in district heating activity, a significant increase in emissions is shown. This can mostly be attributed to an increase in emission intensive fuels used at Aarhus Affaldvarme, as well as a decrease in demand from low emission plants and an increase in demand from more emission intensive plants.

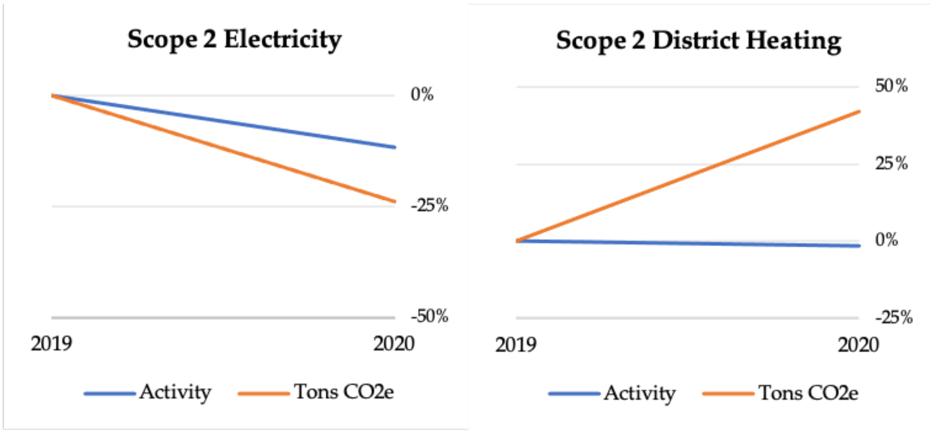


Figure 6*. Comparison of activity and emissions data between 2019 and 2020, with the right axis representing percent change between years.*

3.3 Scope 3

Scope 3 emissions can be interpreted as all other emissions not included in scope 1 and 2. These include a lot of potential emission sources, and typically represent up to 95% of an organisations emission inventory. As such, scope 3 is split into 15 categories as shown in figure 2. The data used in this section include data from multiple parts of the data hierarchy, with the SB and PB methods used.

PB Scope 3 emissions that are able to be compared to 2019 are down 44%. These emissions are based on flight activity, water consumption and waste water generated. Due to the low impact of water generated emissions, flight emissions are the primary component of scope 3. Both flight activity and emissions are down 91%, with consistent cancellations throughout the year, as shown in figure 7 below.

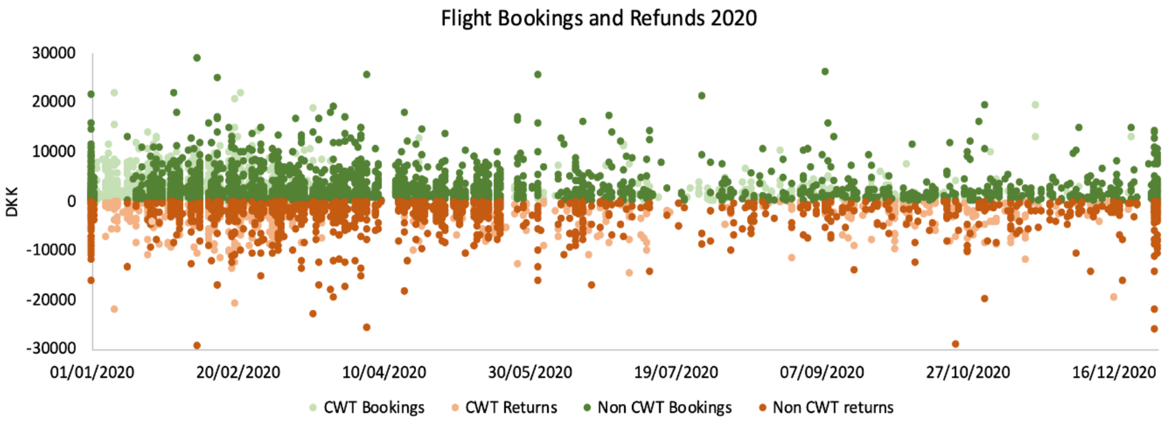


***Figure** 7. Bookings and cancellations throughout the 2020 in DKK.*

Scope 3.1: Purchased Goods and Services

Process Based Water Consumption

Water consumption at AU has been included in previous GHG inventories and continues to be included in this report. This marks the only PB contribution to scope 3.1. The water consumption data is delivered by KMD EnergyKey, an energy consumption system used at AU. The emissions of water consumption in Denmark are defined by a HOFOR report stating that 0.2 g CO_2e are emitted per cubic meter (HOFOR, 2020). The total emissions for AU water consumption (262,647 m^3) results in **52.5 t CO_2e**.

Spend Based Method

The spend based method used in this report is reflective of the activity data we have available for the inventory. A significant part of university operations revolve around procurement of goods and services, and while PB performs well, given the availability of the right data, PB does not accurately nor quickly account for services. On the other hand, the SB approach aligns well with AU's intention of determining indirect and embedded emissions, and only having financial data at this time. This approach will undoubtedly evolve as our inventory evolves. As we don't have resolution in our activity data on the product or service level, using a SB method aligns well with the available data – university financial records.

Purchased Goods

Coverage indicators of the accounted for emissions are described by the fraction of the overall university financial budget, and has been used to prioritize spending categories. The spending categories are distributed across purchased goods and purchased services, and are treated separately. 81% of the money spent of the categories determined to be mainly comprised of purchased goods are converted to emissions. This corresponds to 16% of the overall university finances, which as noted before, is in relation to the total finances, including finances not representing a product or service.

All the relevant finance categories were coupled with EXIOBASE categories, with the help of the finance department. The remaining university finance categories which did not have a clear connection to an EXIOBASE emission factor were noted and allocated to "uncategorized" and should be defined more clearly in following inventories. For completeness's sake, an average of the spend based emission factors was applied to the remaining uncategorised financial accounts and is shown at the bottom of table 6, and at the end of figure 8.

Table 6. *SB emission results and percentage representation of total purchased goods and total economic spending*

Category Names	% Of Purchased Goods (DKK)	% Of Total (DKK)	t CO_2e	Sources
Researcher and Lab. - Equipment, plant, chemicals and laboratory goods and services	57%	11.59%	14,809.9	[1], [2]
IT hardware - servers, computer and accessories, AV equipment etc.	13%	2.66%	4,400.9	[1], [2]
Furniture and interior design	3%	0.58%	1,058.8	[1], [2]
Books, newspapers and magazines	2%	0.42%	912.9	[1], [2]
Equipment (barn, workshop, laboratory, etc.)	2%	0.33%	594.8	[1], [2]
Building materials and tools	1%	0.19%	420.5	[1], [2]
Cell phones	1%	0.18%	303.5	[1], [2]

Printers, MFPs, toner and ink	1%	0.17%	278.4	[1], [2]
Food and beverages	1%	0.14%	360.9	[1], [2]
Office supplies, copy paper and employment materials	1%	0.11%	246.0	[1], [2]
Appliances - purchase and service	0%	0.06%	206.6	[1], [2]
Flowers and gifts	0%	0.04%	68.9	[1], [2]
Fruit arrangement	0%	0.02%	41.9	[1], [2]
Total Uncategorized	19%	4%	7,578.0	[1], [2]
Total CO_{2e}	**81%**	**16%**	**23,704.0**	

[1] Access through Danish Business Authority Tool [2] EXIOBASE v3.3.16b2 (v. 2020 m. 2011-data)

Converting these to emissions results in **23,704.0 t CO_2e**. The largest financial category is the researcher and lab equipment, plant, chemicals, laboratory goods and services. This highlights an important weakness in this method, that part of the spending used to calculate the purchased goods emissions are actually spent on laboratory services. As the process and data becomes clearer, the method will evolve. As the method evolves to include more categories, we can also take a closer look at the hot spot categories identified in this inventory. Taking a step deeper and looking at which main suppliers contribute the most to “lab equipment” and “IT hardware”, presents an opportunity to pass the initiative onto our suppliers. This is the first step in taking a PB approach to our highest emission sources within scope 3.1 and 3.2. It is unclear now whether or not this will increase or decrease the overall emissions, but a very positive outcome, regardless of the effect on emissions, is a more accurate knowledge of product impacts. This will allow AU to compare products, and take it into consideration in future decision making.

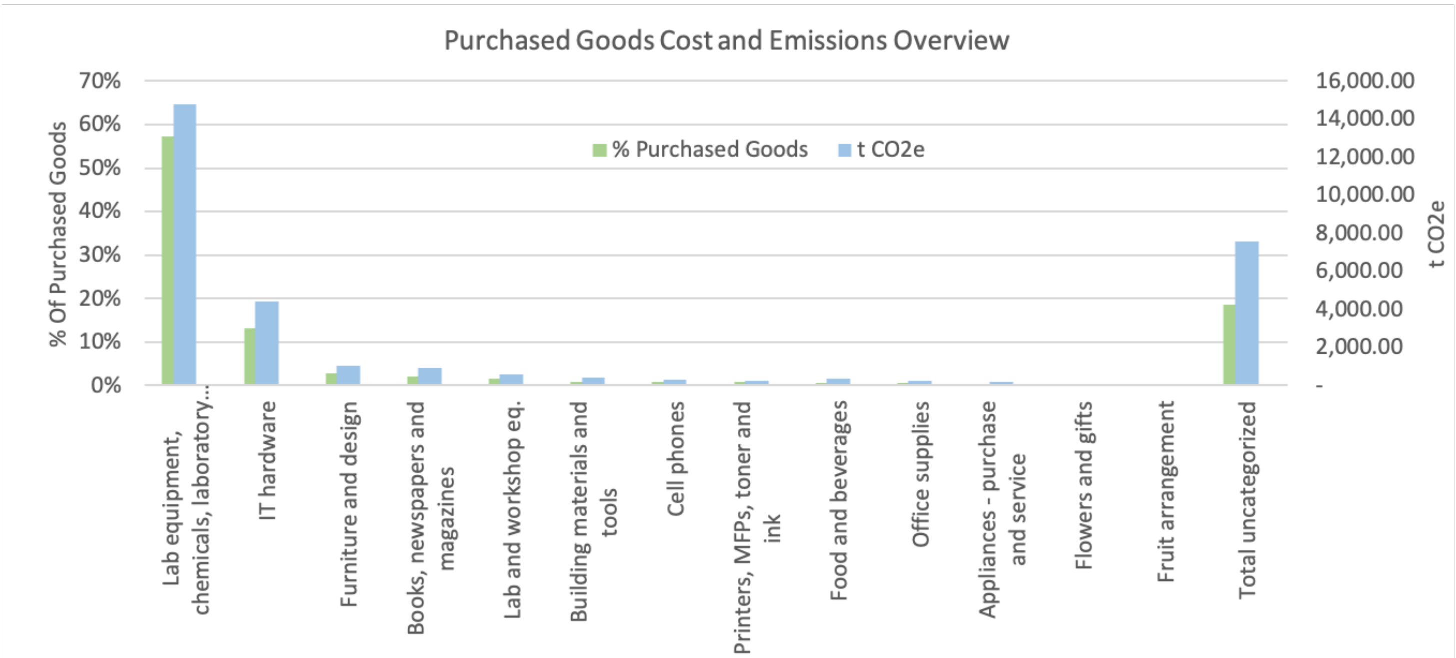


Figure 8. *Spend based results of purchased goods. Activity data, presented in mill. DKK, and their resulting emissions, in t CO_2e are presented across the categories, including those unable to be categorized. The uncategorized emissions are based on an average emission factor.*

Purchased Services

The method used in purchased goods is also applied to the categories determined to be mainly service oriented. A larger number of categories were able to be coupled with EXIOBASE categories, as the emission factors associated with services can be applied to more than one purchased service. Compared to the categories used for goods, which often define a physical product, many services can be grouped under one service emission factor. An example of this is office-based services, which purchased services such as, copyright and plagiarism control, legal services, and auditing services all fit under. Overall, 86% of the university finance categories that fall under services is accounted for, which represents 15% of the overall university finances.

As with purchased goods, the remaining university finance categories which did not have a clear connection to an EXIOBASE category were noted and allocated to “uncategorized” and should be defined more clearly in following inventories. An average emission factor was applied to the remaining uncategorised financial accounts and is shown at the bottom of table 7, and at the end of figure 8.

Table 7. *SB emission results and percentage representation of total purchased services and total economic spending*

Category Names	% of Purchased Services (DKK)	% of Total (DKK)	t CO_2e	Source
Craftsman services	23%	3.90%	8498.3	[1], [2]
IT software systems, cloud services, web domains, etc.	19%	3.26%	2800.9	[1], [2]
Consulting services	17%	2.82%	2781.7	[1], [2]
Technical service and inspection	5%	0.91%	900.6	[1], [2]
Lock service, guard, security and security	5%	0.90%	888.0	[1], [2]
Copyright and plagiarism control	3%	0.57%	563.5	[1], [2]
Cleaning service	2%	0.40%	393.7	[1], [2]
Restaurant and catering	2%	0.39%	1001.9	[1], [2]
Media agency and surveillance	2%	0.26%	254.8	[1], [2]
Fiber network, broadband and telephony	1%	0.17%	208.0	[1], [2]
Legal services	1%	0.17%	167.9	[1], [2]
Mail, couriers and shipments	1%	0.15%	184.5	[1], [2]
Auditing services	1%	0.13%	131.7	[1], [2]
Laundry service	1%	0.13%	147.2	[1], [2]
Window cleaning	1%	0.09%	90.1	[1], [2]
Ventilation service	0%	0.08%	83.3	[1], [2]
Elevator and lift service	0%	0.08%	82.6	[1], [2]
Translations and interpretation services	0%	0.08%	80.5	[1], [2]
Plant service	0%	0.06%	61.9	[1], [2]
Psychological counseling and supervision	0%	0.06%	61.2	[1], [2]
Insurances	0%	0.05%	23.7	[1], [2]
Rental of container, lift, scaffolding, etc.	0%	0.04%	70.8	[1], [2]
Software	0%	0.03%	21.7	[1], [2]
Total Uncategorized	12%	2%	2656.9	[1], [2]
Total CO_2	**86%**	**15%**	**19,498.5**	

[1] Access through Danish Business Authority Tool [2] EXIOBASE v3.3.16b2 (v. 2020 m. 2011-data)

Using the financial activity data and the SB method, the money spent on purchased services results in **19,498.5 t CO_2e**. The largest financial category is the Craftsman services at **8,498.3 t CO_2e**, which is a very broad category and requires a more detailed look at individual services to accurately describe the various services within "craftsman services". Second, and also noteworthy, is the IT software services which contributed **2,800.9 t CO_2e**. As we have seen in media and literature, the emissions associated with online presence is becoming more common and addressed by web service providers, with many providing climate friendly solutions for their clients. 3.2% of the overall finances are allocated to software services, many of which may already have significantly lower emissions than is represented here due to company initiated reductions. This also requires further investigation.

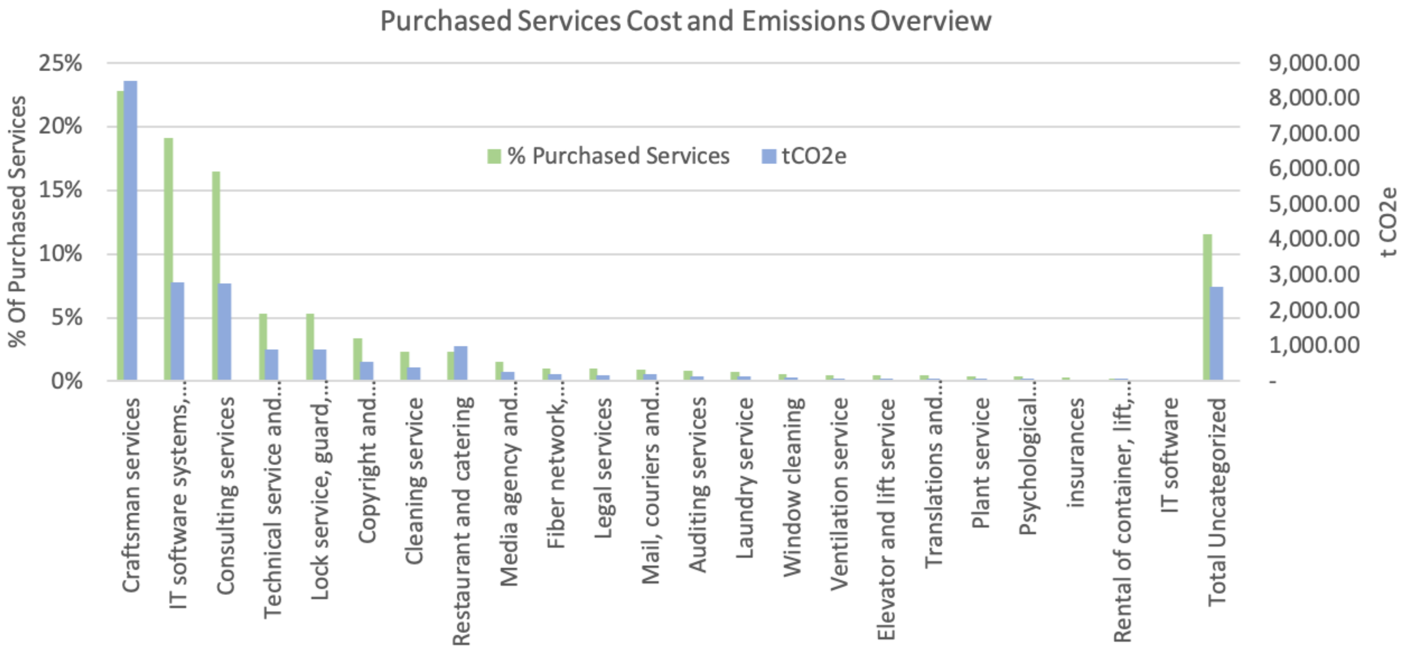


Figure 9. *Spend based results of purchased Services. Activity data, presented in mill. DKK, and their resulting emissions, in t CO_2e are presented across the categories, including those unable to be categorized. The uncategorized emissions are based on an average emission factor.*

Scope 3.2: Capital Goods

As noted above, the method used in this report meant grouping category 3.1 – Purchased Goods and Services together with category 3.2 – Capital Goods as many of the purchases cross the boundary between the two categories. This also requires some further investigation and a clear definition in future inventories.

Scope 3.3: Fuel- and Energy-Related Activities Not Included in Scope 1 or Scope 2

Fuel and energy related emissions are due to the embedded emissions from extraction, refining, and transportation from the extraction to the combustion site. The latest existing literature on the subject has been presented by the Joint Research Centre (JRC), which is the European Commission's science and knowledge service. The report estimates that in 2020, well to tank (WTT) emissions correspond to roughly 25% of the direct emissions of the fuel (Prussi et al., 2020). This is also seen in a Danish Energy Authority report from 2016 which estimated that well to tank emissions stood for 22%-25%. The emission factors for diesel is 26% and petrol is 24%, which are applied to the AU owned transport emissions where the type of fuel is defined, such as L of diesel used in AU service cars (table 8). This is also applied to the research vessel Aurora. For transport related emissions based on km activity data, we assume that an average of the WTT emission factors is sufficient, and that the km activity data is spread evenly across diesel and petrol vehicles. In all, **174.1 t CO_2e** is emitted from WTT emissions related to AU owned transport.

Table 8. *Well to Tank emissions for AU owned transportation*

Source	Amount	Units	EF	Units	Tons CO_2e	Source	Notes
Marine Diesel	162.3	t CO_2e	0.26	%	42.2	[1]	Well to tank emission report for Europe
L Diesel	412.5	t CO_2e	0.26	%	107.2	[1]	Includes emissions for non-road vehicles
L Petrol	30.0	t CO_2e	0.24	%	7.2	[1]	Includes emissions for non-road vehicles
km Driven	69.9	t CO_2e	0.25	%	17.5	[1]	Average of EF for diesel and petrol assuming half and half diesel/petrol vehicles comprising the km driven
Total Upstream Fuel Related Emissions					**174.1**		

[1] Prussi, M., Yugo, M., De Prada, L., Padella, M., Edwards, R., Lonza, L. JEC Well-to-Tank report v5, EUR 30269 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-19926-7, doi:10.2760/959137, JRC119036.

Scope 3.4: Upstream Transportation and Distribution

Given the data analysed in this report, we are unable to determine the emissions from upstream transport and distribution. Using the SB method, the costs allocated to upstream transport and distribution are included in purchased services of category 3.1. Once these are able to be separated, they can be removed from purchased services, and allocated to this category with no major change to the overall emissions inventory.

Scope 3.5: Waste Generated in Operations

Wastewater generated at AU is determined on several assumptions. The water consumption at AU is assumed to be representative of the wastewater produced. Therefore, based on the results from section 3.3, the wastewater produced at AU is 262.647 m^3 in 2020. The emission factor calculation is based on data provided by a 2015 Danish Environmental Protection Agency report (Styrelsen for Vand- og Naturforvaltning, 2015) and calculations done at DCE, described as 0.09 kg CO_2e/m^3, resulting in a wastewater emissions of **23.6 t CO_2e**.

The waste data collected for this report is only reported in kg (table 9). Accurate emission factors based on each waste stream were unable to be determined, and has opened up for a larger conversation regarding the role of waste streams for recycling and energy co-production in GHG inventories. This is to be investigated in the future.

***Table 9**. Waste and recycling streams from AU in total kgs*

Source	Amount	Units
Corrugated cardboard	50672	kg
Landfill	120	kg
E-Waste	36075	kg
Flamingo	0	kg
Plaster	540	kg
Glass	23057	kg
Garden Waste	28303	kg
Iron and metal	24157	kg
Coffee capsules	105	kg
Refrigerant appliances	5385	kg
Light sources	392	kg
Shredding	7489	kg
Paper / cardboard	117493	kg
Plastic	6440	kg

Polypropolene	2080	kg
Small Incineration	642369	kg
Large Incineration	33080	kg
Wood	2840	kg
Total	**980597**	kg

Scope 3.6: Business Travel

AU, as many other universities, have many activities that fall under business travel. In previous inventories, flight data has been included, using a model developed by DCE, which takes into account the radiative forcing effect of flight exhaust emitted at altitude. As the literature on flight based emissions increases, so do the models and the practical application. Therefore, this report uses an updated model, presented by DCE, as well as a SB analysis of remaining finances falling under the business travel category. For future inventories, updated methods and models will represent reductions, but allow for recalculations of previous years to also show actual reductions.

Process Based Emissions

Flight data was provided by the travel agency Carlson Wagonlite Travel (CWT), which AU employees can use for all flight and travel bookings. The data received from CWT has an optimal quality, which can't be matched from submitted travel receipts. However, by looking at the monetary amounts paid through air travel reimbursements compared to the amount spent through CWT, a scaling factor of 2.5 was identified and applied to the CWT data. This assumption does not take into consideration the reasons why employees choose to book outside of CWT, but further research could identify the effects this would have on the overall emissions. The results are described in table 10, as "CWT" emissions and "outside CWT", and combined represent **949.8 t CO_2e**.

Table 10: Business flight emissions from CWT calculated using the DCE flight emission model. Flights booked outside CWT represent a larger fraction of flights booked with CWT, therefore the CWT emission data is scaled by a factor of 2,5.

Flights	Data Source		tCO_2e incl. RF	Source
APU	Total, CWT Flights		0.1	[1],[2]
Cruise	Total, CWT Flights		265.9	[1],[2]
LTO	Total, CWT Flights		5.3	[1],[2]
Total	Total, CWT Flights		271.4	[1],[2]
	Total, other travel		678.4	[1],[2]
	All travel		**949.8**	
Flights	**Km**	**Unit**	**tCO_2e incl. RF**	**Source**
CWT	1,659,939	km	271.4	CWT
Outside CWT	4,149,848	km	678.4	University Accounting
Total Flights	**5,809,788**		**949.8**	

APU (Auxilliary Power Units) LTO (Landing and Take Off, under 3000 feet) Cruise (Cruising at altitude) [1] Emission factors from DCE's flight emissions model (Winther, M. 2018: Danish emission inventories for road transport and other mobile sources. Inventories until the year 2016. Aarhus University, DCE – Danish Centre for Environment and Energy, 127pp. Scientific Report from DCE – Danish Centre for Environment and Energy No. 277. http://dce2.au.dk/pub/SR277.pdf.) [2] Radiative forcing data based on Larsson and Kamb (2018). See Larsson, J., Kamb, A. 2018: Semestern och klimatet, Metodrapport. Version 1.0, 30 pp., Chalmers Tekniska Högskola, Göteborg, maj 2018.

Emissions from flying were lower due to COVID-19 travel restrictions. This is clearly shown in figure 6, as almost all of the flights booked were eventually cancelled or refunded. It is expected that once restrictions are lifted, the emissions will once again be responsible for a larger part of AU's overall impact.

Spend Based Emissions

Business travel is not limited to flights, despite flights being an important contributor to any GHG inventory. In addition to business flights are other transport types, as well as hotel stays. Using the university finance categories, money spent on flights were first removed as to avoid double accounting, the remaining transport related costs were then identified and linked with EXIOBASE categories, which extended the business travel emissions to include hotel stays, bus, trains, and ferries. This is an important aspect for AU, as AU has many campuses around Denmark, all of which are accessible by train, or bus and ferry.

The AU finance category for hotels also includes conference venues, which may make up a significant portion of the value (table 11). It is possible that this is not the case, as the majority of physical conferences were cancelled in 2020 due to COVID. These were unable to be split out, and as a result, the emissions from hotels and conferences provide a rough estimate of the actual emissions impact. This will be investigated in future inventories, and is expected to change as COVID restrictions change.

Table 11: Business travel emissions as reported through the SB method

Category Names	% Of Transport	% Of Total	tCO2e	Source
Hotels and conference venues	52%	0.58%	1478.3	[1,[2]
Transport - bus and train	6%	0.07%	60.0	[1,[2]
Transport - ferry	3%	0.03%	50.4	[1],[2]
Total Accounted Spend	**61%**	**0.68%**	**1588.6**	

[1] Access through Danish Business Authority Tool [2] EXIOBASE v3.3.16b2 (v. 2020 m. 2011-data)

The SB method resulted in **1,588.6 t CO_2e** within business travel, with the most significant contributor being hotels and conference venues, approximately half of the business travel expenses of AU.

Between the PB and SB methods, 95% of the economic spending within business travel is accounted for, which is approximately 1% of the overall spending.

Scope 3.7: Employee Commuting

One way to approach a GHG inventory, is to consider what are the vital components of the organisation in question. In a university's case, the students as well as the researchers are vital to the operations of a university. This has not been included in previous AU GHG inventories, and therefore, employee and student commuting will be included in future inventories. 2020 was not an ideal year for determining the emissions associated with commuting habits due to Covid-19 related lockdowns in Denmark, so efforts have been focussed elsewhere, with the intention of collecting them for 2022.

The method for collecting this data will be through a questionnaire delivered to students and employees, by individual campuses. The results will then be statistically analysed, and transport emission factors will be applied.

Scopes 3.8 – 3.14

The GHG Protocol scope 3 categories that are not as relevant to a university GHG inventory are described here. There are without a doubt some university activities that fall under the categories described in table 12, however we do not expect them to contribute significantly to the AU GHG inventory. As such, they are prioritized lower than the upstream related categories addressed above. As the inventory will evolve and grow, activities within these categories should be included, for a true representation of AU's emissions impact.

It should be noted here that as AU rents most of their buildings, the associated emissions would be expected to fall under category 3.8. However, as this inventory takes an operational control approach, as defined by the GHG Protocol, the resulting emissions are allocated to scope 1 and 2.

Table 12. *Description of categories with little to no relevance to the AU GHG inventory, and therefore not a priority in this report*

Scope 3 category	Category name	Quick Description
8	Upstream Leased Assets	Emissions from the operation of assets that are leased by the reporting company in the reporting year and not already included in the reporting company's scope 1 or scope 2 inventories. [1]
9	Downstream Transport and Distribution	Emissions that occur in the reporting year from transportation and distribution of sold products in vehicles and facilities not owned or controlled by the reporting company. [1]

10	Processing of Sold Products	Emissions from processing of sold intermediate products by third parties (e.g., manufacturers) subsequent to sale by the reporting company. [1]
11	Use of Sold Products	Emissions from the use of goods and services sold by the reporting company in the reporting year. [1]
12	End-of-Life Treatment of Sold Products	Emissions from the waste disposal and treatment of products sold by the reporting company (in the reporting year) at the end of their life. [1]
13	Downstream Leased Assets	Emissions from the operation of assets that are owned by the reporting company (acting as lessor) and leased to other entities in the reporting year that are not already included in scope 1 or scope 2. [1]
14	Franchises	Emissions from the operation of franchises not included in scope 1 or scope 2. [1]

[1] Bhatia, P., Cummis, C., Rich, D., Draucker, L., Lahd, H., & Brown, A. (2011). Corporate Value Chain (Scope 3) Accounting and Reporting Standard. In WRI and WBSCD.

Scope 3.15: Investments

AU has a significant investment portfolio with several large Danish banks. These actions also have a quantifiable amount of embedded emissions, however the method for determining this falls outside the scope of this report. AU requested ESG and emission reports from our banks, and Danske Bank was able to deliver a definite number. This is based on AU financially related investment of the individual company's scopes 1 and 2 emissions, and shown in table 13.

Table 13. *Investment related emissions taken from ESG reports from Danske Bank with whom AU has investment portfolios with*

Source	**Tons CO_2e**	**Source**	**Notes**
Danske Bank Q1	1382	Danske Bank ESG Report	
Danske Bank Q2	1157	Danske Bank ESG Report	
Danske Bank Q3 (estimated)	1269.5	Danske Bank ESG Report	Average of Q1 and Q2
Danske Bank Q4 (estimated)	1269.5	Danske Bank ESG Report	Average of Q1 and Q2
Total	**5078.0**		

4. Conclusions and future Plans

This report marks the first expansion of the GHG inventory at AU, from the initial assessment in 2018. The intention of any emissions inventory is to provide the basis for climate resilient decision making by adding another layer of information to any possible decision in the future. AU has, from the start, had a good grasp on their scope 1 and 2 emissions, and this report continues this path into more scope 3 emissions.

This analysis found that Aarhus Universities emissions have increased from previous years as our method develops, and more emission sources are considered. Combining both the PB and SB methods result in an overall total of **65,237.0 t CO_2e**, of which scope 1 emissions account for **6,082.0 t CO_2e**, scope 2 emissions for **8,085.8 t CO_2e**, and scope 3 emissions for **51,069.2 t CO_2e**.

The majority of the emissions included in this report are done so under a process based method, using itemized activity data such as kWh and L of fuel. This means that the results are the most accurate representation of the emissions of each activity. This is not to underestimate the importance of the spend based results however, as we have identified, and estimated, emissions from important actors and actions that fall within university operations.

The 2020 report sets the stage for refinement and development of the AU GHG Inventory. These betterments can be divided into refining the existing activity data, expanding data collection to include categories not included in this report, and expanding the spend based method to assess across more detailed sectors related to our AU economic accounting.

By refining our existing activity data, we will be able to include emissions from more sources of AU overall investments and differentiating the procurement emissions between scopes 3.1 and 3.2. This means clearer divestment solutions are possible, and policy decisions can be made surrounding purchasing plans of multi-year goods.

Expanding the data collection will allow AU to include more GHG protocol categories, such as commuting and waste, through student and employee commuting investigations, and collaboration with our waste service providers. This will allow AU to take a PB approach to categories 3.5 and 3.7. Having identified top suppliers within procurement through the SB method means that we will be able to begin dialogues with each supplier. By asking them for climate data, or itemized purchase data, we will both be motivating the green transition of our top suppliers, as well as getting the foundation for a PB analysis on certain products. This will remove activity under the SB method and over to the PB method, which will increase the accuracy of the results.

The SB method in this report left several economic posts to be grouped together in an "uncategorized" description. It's the intention that for next year, the model will become more refined, and shift activities from "uncategorized" to more accurate descriptions with more relevant emission factors. This will in part be due to collaborations between the Danish Universities, as well as through a closer working relationship with the AU economic department.

Based on these conclusions, AU is perpetuating the green transition, just as much as engaging with it, through this and future reports.

Acknowledgements:

The Authors would like to thank Aarhus University for the support to develop this document. We would like to thank all the co-workers from the University who have helped compile all the data. In particular we want to thank Andreas Staunbjerg and Susanne Søes Hejlsvig from the sustainability team at AU.

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