IMPROVING THE GREENHOUSE GAS INVENTORY FOR THE FAROE ISLANDS

Scientific Report from DCE – Danish Centre for Environment and Energy No. 518 2022

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Data sheet

Series title and no.: Scientific Report from DCE – Danish Centre for Environment and Energy No. 518

Category: Scientific advisory report

Title: Improving the greenhouse gas inventory for the Faroe Islands

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Publisher: Aarhus University, DCE – Danish Centre for Environment and Energy ©
URL: http://dce.au.dk/en

Year of publication: December 2022
Editing completed: November 2022

Referee: Marlene S. Plejdrup, Department of Environmental Science
Quality assurance, DCE: Vibeke Vestergaard Nielsen

Financial support: The project was funded by the programme "Climate support for the Arctic" under the Ministry of Climate, Energy and Utilities.

Please cite as: Nielsen, O.-K., Winther, M., Mikkelsen, M.H., Bruun, H.G. & Gyldenkærne, S. 2022. Improving the greenhouse gas inventory for the Faroe Islands. Aarhus University, DCE – Danish Centre for Environment and Energy, 47 pp. Scientific Report No. 518
http://dce2.au.dk/pub/SR518.pdf

Abstract: This report documents improvements made to the greenhouse gas inventory of the Faroe Islands. The improvements covered all major sectors and included whole sectors previously unaccounted for in the Faroese greenhouse gas inventory.

Keywords: Faroe Islands, greenhouse gas emissions, UNFCCC, IPCC, emission inventory

Layout: Ann-Katrine Holme Christoffersen
Front page photo: COLOURBOX7255485

ISBN: 978-87-7156-728-1
ISSN (electronic): 2245-0203

Number of pages: 47

Internet version: The report is available in electronic format (pdf) at
http://dce2.au.dk/pub/SR518.pdf

Contents

Preface

This report documents the improvements made to the greenhouse gas inventory of the Faroe Islands as part of the project “Forbedring af drivhusgasopgørelsen for Færøerne”. The project was funded by DANCEA (Danish Cooperation for Environment in the Arctic) and was carried out from 2020 to 2022 by experts from the Department of Environmental Science at Aarhus University in cooperation with Umhvørvisstovan (Faroese Environment Agency). The outcomes of the project has been reflected in the reporting to the United Nations Framework Convention on Climate Change starting in 2021 and with full implementation in the 2022 submission.

The authors of the report would like to thank Umhvørvisstovan and especially Maria Gunnleivsdottir Hansen for the great cooperation and assistance during the project.

Summary

The Kingdom of Denmark is Party to the United Nations Framework Convention on Climate Change (UNFCCC) and therefore has obligations to estimate and report emissions of greenhouse gases annually. The improvements made in this project was included in the reporting to the UNFCCC partly in 2021 and fully in 2022.

The reports to the UNFCCC are subjected to reviews, where an international team of experts selected by the UNFCCC Secretariat analyses the submission and formulates recommendations for improvements. During the reviews, there have been specific recommendations related to the completeness of the greenhouse gas inventory for the Faroe Islands.

In this project, the Faroese inventory was analysed to assess the adherence to the UNFCCC Reporting Guidelines (UNFCCC, 2013) and the 2006 IPCC Guidelines (IPCC, 2006). The focus was to ensure that the inventory was complete and that the accuracy was the best possible. The results of the analysis and the improvements made in response to this are described for each IPCC main sector in this report.

For the energy sector, the analysis showed that the inventory was complete in terms of coverage of sources. However, two other areas for improvement were identified and addressed during the project. The emissions associated with road transport were reported as a total without disaggregation to vehicle categories. This was addressed using data from the Faroe Islands combined with assumptions and data from the Danish road transport emission model. This allowed the emissions to be disaggregated on vehicle types (cars, light-duty trucks, heavy-duty trucks and buses, and two-wheelers (motorcycles and mopeds). The second identified area for improvement was the lack of the reference approach calculation for the energy sector. Based on import / export data collected from the statistical organisation, a first version of the reference approach was elaborated and reported. The comparison to the sectoral approach shows relatively large discrepancies for some years and this should be further investigated in the future.

For industrial processes and product use (IPPU), the analysis showed that the most important source (use of fluorinated gases) was complete and as there is no heavy industry in the Faroe Islands, only a few minor sources were identified as missing. These two sources were use of lubricants and use of paraffin wax. Statistical data was collected allowing an estimation of the use of lubricants and waxes in the Faroe Islands and emissions were estimated using the default Tier 1 methodology contained in the 2006 IPCC Guidelines.

For agriculture, the analysis showed that a number of sources had not previously been estimated (e.g. emissions from mineral fertiliser use, animal manure applied to soils, crop residues and leaching and runoff) and that only simple Tier 1 methodologies were used. These identified areas for improvement was addressed through this project and was included in the reporting to the UNFCCC in 2022.

For land use, land-use change and forestry (LULUCF), the Faroe Islands had not previously included any information in the UNFCCC reporting. As part

of this project a land use matrix was developed for the Faroe Islands and emissions were estimated and included in the UNFCCC reporting for all relevant land use categories (forests, grassland and settlements).

Regarding the waste sector, no emissions had been reported previously by the Faroe Islands. As part of this project, emissions from solid waste disposal on land and wastewater handling were estimated and included in the reporting. In the future, emissions from anaerobic digestion (a plant opened in 2020) and composting should be considered and included in the reporting, if relevant.

In total, the impact for the energy, IPPU and waste sectors were very limited with the largest impact coming from the inclusion of sources within the waste sector. The largest impacts were seen due to the changes in the agricultural and LULUCF sectors.

As the emissions from the agricultural and LULUCF sectors are relatively constant over time, the change in total emissions for the Faroe Islands are relatively constant throughout the time-series.

The highest percentage impact is for 1994, where the improvements made lead to an increase in the estimated emissions of 22 %. For the majority of the years, the impact is an increase in emissions of between 10 and 15 %, with the lowest impact being in 2018 with 9.3 %.

Sammenfatning

Kongeriget Danmark har ratificeret FN's rammekonvention om klimaforandringer (klimakonventionen – UNFCCC) og er derfor underlagt krav om årligt at beregne og rapportere emissioner af drivhusgasser. De forbedringer, der er lavet i forbindelse med dette projekt blev delvist inkluderet i rapporteringen til UNFCCC i 2021 og fuldstændigt i 2022 afleveringen.

Rapporteringerne til UNFCCC er underlagt revisioner (reviews), hvor et internationalt hold af eksperter sammensat af UNFCCC-sekretariatet analyserer rapporteringen og formulerer anbefalinger til forbedringer. Gennem denne review-proces er der fremkommet specifikke anbefalinger relateret til Færøernes del af den samlede emissionsopgørelse for Kongeriget.

I dette projekt er den færøske emissionsopgørelse blevet analyseret med henblik på at vurdere overholdelsen af kravene i UNFCCC retningslinjer for rapportering (UNFCCC, 2013) og IPCC's retningslinjer (IPCC, 2006). Fokus har været på at sikre, at emissionsopgørelsen er komplet med hensyn til dækning af kilder samt at sikre den bedst mulige nøjagtighed af emissionsopgørelsen. Resultaterne af denne analyse og de forbedringer, der er foretaget på baggrund heraf, er beskrevet for hver af hovedsektorerne som defineret af IPCC i denne rapport.

For energisektoren, så viste analysen, at emissionsopgørelsen var komplet i forhold til dækning af kilder og gasser. Der blev dog identificeret to områder, hvor emissionsopgørelsen kunne forbedres og som blev adresseret som en del af dette projekt. Emissionerne fra vejtransport blev tidligere rapporteret som en samlet total uden skelnen mellem køretøjskategorier. Dette blev adresseret ved anvendelse af data fra Færøerne kombineret med antagelser og data fra den danske vejtransportmodel. Dette muliggjorde en opdeling på køretøjskategorier (personbiler, varebiler, lastbiler og busser samt motorcykler og knallerter). Det andet område, der blev identificeret var manglen på en referencemetode for Færøerne for energisektoren. Baseret på import/eksport data fra Færøernes Statistik er der udarbejdet en første udgave af referencemetoden og den blev inkluderet i rapporteringen til UNFCCC. Sammenligningen mellem referencemetoden og sektormetoden viser store afvigelser for nogle år, og dette bør undersøges nærmere i fremtiden.

For industrielle processer og produktanvendelse viste analysen, at den vigtigste kilde (anvendelsen af fluorerede gasser) var komplet. Da der ikke er nogen tung industri i Færøerne med relaterede procesemissioner, så blev der kun identificeret to meget små kilder, som manglede i emissionsopgørelsen. Disse to kilder var anvendelsen af smøreolie samt anvendelsen af voks (i form af levende lys). Statistiske data blev indsamlet, hvilket muliggjorde beregningen af emissioner fra disse aktiviteter baseret på den simple metode (Tier 1) beskrevet i IPCC's 2006 retningslinjer.

For landbrugssektoren viste analysen, at flere kilder hidtil havde være udeladt fra emissionsopgørelsen (f.eks. emissioner fra handelsgødning, udbringning af husdyrgødning, afgrøderester og udvaskning), og at der for øvrige kilder blev anvendt en simpel metode (Tier 1). De identificerede mangler blev adresseret gennem dette projekt, og resultaterne blev inkluderet i rapporteringen til UNFCCC i 2022.

Arealanvendelse og ændringer i arealanvendelse (LULUCF) var ikke en del af den færøske emissionsopgørelse. Som en del af dette projekt er der udarbejdet en emissionsopgørelsen for LULUCF-sektoren i Færøerne. Dette indebar udarbejdelsen af en arealanvendelsesmatrice for Færøerne og beregning af emissioner for alle relevante arealanvendelseskategorier (skov, græsarealer og bymæssig bebyggelse). Resultaterne blev inkluderet i 2022-rapporteringen til UNFCCC.

Der var ikke tidligere rapporteret emissioner fra affaldssektoren i den færøske emissionsopgørelse. Som en del af dette projekt er emissioner fra affaldsdeponier og spildevandsbehandling blevet inkluderet i emissionsopgørelsen, og blev rapporteret i 2021 til UNFCCC. I fremtiden bør det overvejes, om det er relevant at inkludere emissioner fra biogasanlæg (et anlæg åbnede i 2020) og kompostering i emissionsopgørelsen.

Samlet set var ændringerne i emissioner for energisektoren, industrielle processer og affaldssektoren meget begrænsede. Den største ændring kom fra inkluderingen af emissioner fra affaldssektoren. De største ændringer skete på baggrund af de forbedringer, der blev foretaget i landbrugssektoren og LULUCF-sektoren.

Da emissionerne fra landbrugssektoren og LULUCF-sektoren er relativt konstante over tid, så er ændringen i Færøernes samlede emission også relativt konstant gennem tidsserien.

Procentuelt er den største ændring for 1994, hvor de gennemførte forbedringer har medført en stigning i de beregnede emissioner på 22 %. For de fleste år er betydningen af forbedringerne på den samlede emission en stigning på mellem 10 og 15 %. Den laveste betydning er for 2018, hvor forbedringerne medførte en stigning på 9,3 %.

1 Introduction

The Kingdom of Denmark is Party to the United Nations Framework Convention on Climate Change (UNFCCC) and therefore has obligations to estimate and report emissions of greenhouse gases annually.

DCE – National Centre for Environment and Energy at Aarhus University is contracted by the Ministry of Environment and the Ministry of Climate, Energy and Utilities to estimate and report the greenhouse gas emission inventory in order to fulfil Denmark's obligations under EU and UNFCCC. In addition, DCE is responsible for aggregating and reporting to the UNFCCC for the Kingdom of Denmark. The Kingdom consists of Denmark, the Faroe Islands and Greenland, with each part of the Kingdom having separate statistical systems. Greenhouse gas emissions are therefore calculated individually and aggregated before reporting to the UNFCCC.

For the Faroe Islands, the responsible institution is Umhvørvisstovan (Faroese Environment Agency – FEA). Statistics Greenland is responsible for preparing the greenhouse gas inventory for Greenland.

The reports to the UNFCCC are subjected to reviews, where an international team of experts selected by the UNFCCC Secretariat analyses the submission and formulates recommendations for improvements. During the reviews, there have been specific recommendations related to the completeness of the greenhouse gas inventory for the Faroe Islands.

In this project, the Faroese inventory was analysed to assess the adherence to the UNFCCC Reporting Guidelines (REF) and the 2006 IPCC Guidelines (IPCC, 2006). The focus was to ensure that the inventory was complete and that the accuracy was the best possible. The results of the analysis and the improvements made in response to this are described for each IPCC main sector in the following chapters.

Table 1.1 shows the changes in emissions for 1990, 1995, 2000, 2005, 2010, 2015 and 2018 between the 2020 submission and the 2022 submission to illustrate the impact of the improvements carried out within the project.

Table 1.1 Overview of the changes in emissions between the 2020 and 2022 submissions, kt CO_2 equivalents.

	1990	1995	2000	2005	2010	2015	2018
Energy	0.42	0.33	0.39	0.54	0.36	0.27	-0.93
Industrial processes and product use	1.81	1.24	1.41	1.23	1.22	1.30	1.27
Agriculture	65.21	64.84	65.24	65.47	65.09	64.71	63.73
Land use, land-use change and forestry	34.02	34.28	34.56	35.09	35.24	35.32	35.34
Waste	6.29	6.30	6.62	7.62	8.21	8.83	9.27
Total	107.75	106.99	108.22	109.95	110.11	110.43	108.67

The changes in the energy sector is due to regular recalculations initiated by the Faroese Environment Agency. For the remaining sectors, the changes in emissions are due to the improvements made as part of this project. For Land use, land-use change and forestry (LULUCF) and the waste sector, no emission estimates were previously included.

The change in emissions are relatively constant throughout the time-series as illustrated in Figure 1.1.

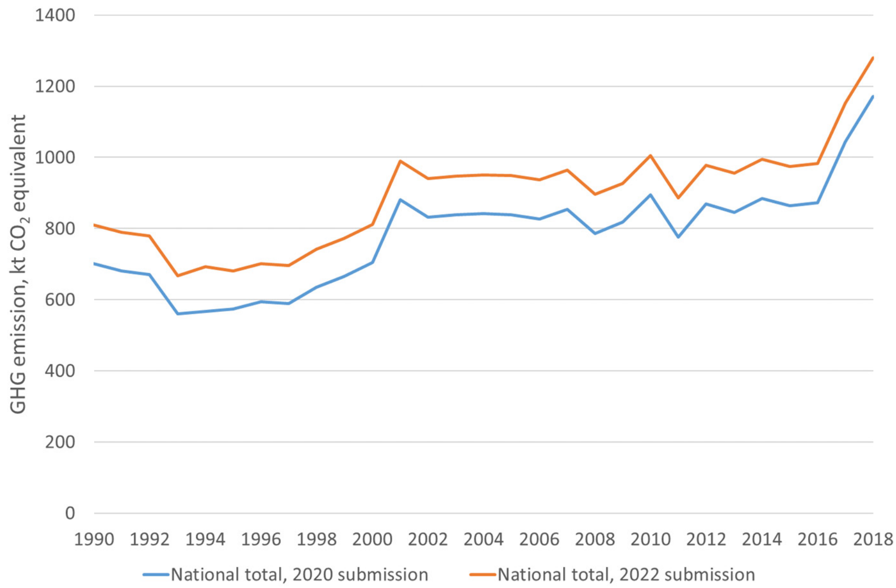

Figure 1.1 Comparison of the national total greenhouse gas emission between the 2020 and 2022 submission.

The highest percentage impact is for 1994, where the improvements made lead to an increase in the estimated emissions of 22 %. For the majority of the years, the impact is an increase in emissions of between 10 and 15 %, with the lowest impact being in 2018 with 9.3 %.

2 Energy

The analysis of the reporting for the energy sector of the Faroese greenhouse gas inventory showed that the reporting was complete and mostly consistent with the reporting requirements. However, for road transport, emissions reported were aggregated for the whole sector and not by individual vehicle types as prescribed by the reporting guidelines. Additionally, the reference approach was not included in the Faroese submissions to the UNFCCC.

2.1 Road transport

2.1.1 Vehicle stock

For the split of the vehicle stock in the emission model for road transport in the Faroe Islands, data from Akstovan (the Faroese road vehicle inspection authority) is being used (SS03050_SAMF_AKFOR) as basis. The dataset includes data for the vehicle stock distributed on vehicle types back to 1980 and therefore covers the entire time-series relevant for the greenhouse gas inventory.

The dataset does not include data for the years 1990 to 1993, therefore these years are estimated using linear interpolation between 1989 and 1994. The data is shown in Table 2.1.

Table 2.1 Vehicle stock in the Faroe Islands 1990-2020 by vehicle type.

Stat. date	Year	Trucks[1]	Vans	Buses	Taxis	Other cars	Motorbikes	Mopeds[2]	Trailers	Emergency vehicles[3]
1.1.1990	1989	559	2993	118	232	13986	113	252	773	88
1.1.1991	1990	532	2850	115	210	13432	115	256	794	88
1.1.1992	1991	505	2707	113	188	12878	117	260	815	88
1.1.1993	1992	478	2563	110	167	12324	118	264	836	88
1.1.1994	1993	452	2420	108	145	11770	120	268	857	88
1.1.1995	1994	425	2276	105	123	11216	122	272	878	88
1.1.1996	1995	420	2253	106	116	11528	132	295	949	88
1.1.1997	1996	428	2292	104	105	12091	126	281	1024	88
1.1.1998	1997	451	2416	111	107	12748	145	324	1078	88
1.1.1999	1998	470	2521	130	103	13319	151	337	1125	88
1.1.2000	1999	501	2685	137	92	14087	167	373	1179	88
1.1.2001	2000	519	2781	155	91	14624	185	413	1245	88
1.1.2002	2001	582	2940	176	95	15615	213	476	1353	88
1.1.2003	2002	614	3155	191	90	16356	254	567	1502	88
1.1.2004	2003	636	3282	201	92	16993	378	844	1638	93
1.1.2005	2004	645	3360	207	93	17420	498	1180	1746	99
1.1.2006	2005	610	3407	214	100	18041	567	1526	1868	103
1.1.2007	2006	618	3610	224	101	19110	859	1622	2047	108
1.1.2008	2007	626	3882	232	109	20225	926	1749	2216	115
1.1.2009	2008	621	3990	249	104	20293	949	1754	2363	130
1.1.2010	2009	591	3865	230	101	19873	922	1737	2437	132
1.1.2011	2010	564	3773	223	99	19897	899	1663	2487	158
1.1.2012	2011	529	3685	221	98	20050	903	1674	2595	159
1.1.2013	2012	510	3603	215	99	20338	915	1659	2761	144
1.1.2014	2013	512	3598	222	101	20817	924	1605	2951	148
1.1.2015	2014	539	3582	216	110	21417	953	1592	3125	150
1.1.2016	2015	562	3685	211	105	22188	969	1577	3376	151
1.1.2017	2016	588	3773	215	109	23233	981	1532	3595	154
1.1.2018	2017	626	3913	212	109	24213	1049	1539	3816	154
1.1.2019	2018	665	4104	203	107	25226	1075	1583	4047	150
1.1.2020	2019	712	4309	197	69	26344	1113	1652	4225	133
1.1.2021	2020	763	4580	202	43	27051	1134	1747	4479	84

[1] For 1990-1999, the statistics only include the total number of trucks and vans. For these years, the vehicle stock has been split using the percentage distribution for the categories in 2020.

[2] For 1990-2002, the statistics does not include stock for mopeds. For these years, the number of mopeds has been based on the ratio between mopeds and motorcycles in 2003 and applying this to the number of motorcycles for 1990-2002.

[3] For 1990-2001, the statistics does not include information on stock. The stock in 2002 has been assumed for 1990-2001.

The stock data per vehicle type from Akstovan is divided into the means of propulsion (gasoline, diesel and electricity) based on percentage distributions for the vehicle stock derived from Hagstova's (Statistics Faroe Islands) data available for the years 2007 onwards.

For the years prior to 2007, the percentage distribution for 2007 is used for all vehicle categories with the exception of the primary category 'Other cars'. For this category an assumption has been made that the share of diesel fuelled cars increased between 1990 and 2007 based on the development in the Danish vehicle stock between those years.

2.1.2 Emission factors and mileage

Emission factors in gram per kilometre driven in urban and rural areas for the individual vehicle categories and fuel types (gasoline and diesel) are derived from the Danish emission inventory in aggregated vehicle categories as shown in Table 2.2. The weighted emission factors are estimated for all inventory years, i.e. from 1990 onwards.

In the calculation of the weighted emission factors, the Danish age and size distribution of vehicles for each vehicle category and the mileage driven in urban and rural areas in each inventory year are utilised.

Table 2.2 shows the vehicle categories, fuels and weighted groupings of emission factors used in the road transport emission model for the Faroe Islands.

Table 2.2 Vehicle categories, fuels (gasoline and diesel) and weighted emission factor groups (EFG) used in the model.

FO name	DK name	Sector	CRF	Fuel	EFG	Fuel	EFG
Brandbilar	Brandsluknings-køretøjer	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	Sololastbil
Bussar	Busser	Road transport - Heavy duty trucks and buses	1A3b iii	Gasoline	Bus	Diesel	Rutebus 15-18t
EllisAkfør	Veteranbiler	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	PC
EllisMo-torsúkklur	Veteran-motorcykler	Road transport - Motorcycles and mopeds	1A3b iv	Gasoline	Motorcycle		
EllisPrutl	Veteranknallerter	Road transport - Motorcycles and mopeds	1A3b iv	Gasoline	Moped		
Hýruvognar	Hyrevogne	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	PC
Kampingbilar	Autocampere	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	PC
Lastbilar	Lastbiler	Road transport - Heavy duty trucks and buses	1A3b iii	Gasoline	Truck	Diesel	Diesel Sololastbil
Leguvognar	Liggevogne	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	PC
Lendisakfør	Terrænkøretøjer	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	PC
Líkvognar	Rustvogne	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	PC
Motorsúkklur	Motorcykler	Road transport - Motorcycles and mopeds	1A3b iv	Gasoline	Motorcycle		
Neyðsen-darakfør	Udryknings-køretøjer	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	Sololastbil
Persónbilar	Personbiler	Road transport - Cars	1A3b i	Gasoline	PC	Diesel	Diesel PC
Prutl	Knallerter	Road transport - Motorcycles and mopeds	1A3b iv	Gasoline	Moped		
Smábussar	Minibusser	Road transport - Heavy duty trucks and buses	1A3b iii	Gasoline	Bus	Diesel	Rutebus <15t
Sópimaskinur	Fejemaskiner	Road transport - Heavy duty trucks and buses	1A3b iii	Gasoline	Truck	Diesel	Sololastbil
Tangabilar	Tankvogne	Road transport - Heavy duty trucks and buses	1A3b iii	Gasoline	Truck	Diesel	Sololastbil
Vøruvognar	Varebiler	Road transport - Light duty trucks	1A3b ii	Gasoline	Van	Diesel	Diesel LDV

Note: PC = Passenger Car, LDV = Light Duty Vehicle.

2.1.3 Fuel use and emissions

The fuel use and emissions from the individual vehicle and fuel categories are in the first step calculated as a multiplication of the energy consumption factor in MJ per kilometre and the emission factor in gram per kilometre driven and the annual mileage in urban and rural areas.

The results from step one is summed to totals for gasoline and diesel, respectively. Then the results are scaled using the ratio between the registered amounts of fuel sold and the amounts calculated in step one.

Table 2.3 shows the ratios calculated for selected years throughout the time-series.

Table 2.3 Fuel scaling factors for gasoline and diesel.

Fuel type	1990	1995	2000	2005	2010	2015	2019
Diesel	0.45	0.53	0.81	0.87	0.86	0.83	0.96
Gasoline	0.97	1.01	0.82	0.88	1.07	1.08	1.10

As seen from Table 2.3, there is generally a good consistency between the bottom-up calculated fuel consumption and the registered sale, especially in later years, where the statistical data are better.

Table 4 shows the final energy consumption and the greenhouse gas emissions (CO_2 (carbon dioxide), CH_4 (methane) and N_2O (nitrous oxide)) for road transport in the Faroe Islands per UNFCCC reporting category (CRF) in 5-year intervals since 1990.

Table 2.4 Fuel use (GJ) and CO_2, CH_4 and N_2O emissions from road transport for 1990-2020 (5-year increments).

	CRF code	CRF name	1990	1995	2000	2005	2010	2015	2020
Energi (GJ)	1A3b i	Road transport - Cars	523180	486131	515379	660200	739813	742183	857821
	1A3b ii	Road transport - Light duty trucks	110117	93531	159633	177264	187650	168255	240195
	1A3b iii	Road transport - Heavy duty trucks and buses	138869	132189	236414	311094	289152	297579	410329
	1A3b iv	Road transport - Motorcycles and mopeds	1542	1824	1837	4832	6827	6910	8757
		Total	773708	713676	913263	1153391	1223442	1214927	1517102
CO_2 (tonnes)	1A3b i	Road transport - Cars	38233	35529	37712	48383	54250	54489	63057
	1A3b ii	Road transport - Light duty trucks	8136	6911	11803	13104	13872	12442	17792
	1A3b iii	Road transport - Heavy duty trucks and buses	10276	9782	17494	23021	21397	22021	30405
	1A3b iv	Road transport - Motorcycles and mopeds	113	133	134	353	498	504	639
		Total	56757	52355	67143	84860	90018	89456	111893
CH_4 (tonnes)	1A3b i	Road transport - Cars	22.379	15.546	9.517	6.451	4.109	2.295	1.770
	1A3b ii	Road transport - Light duty trucks	0.871	0.683	0.690	0.473	0.256	0.099	0.047
	1A3b iii	Road transport - Heavy duty trucks and buses	1.180	1.176	2.042	2.480	1.205	0.513	0.337
	1A3b iv	Road transport - Motorcycles and mopeds	0.214	0.256	0.265	0.611	0.675	0.589	0.591
		Total	24.644	17.662	12.515	10.015	6.245	3.495	2.746
N_2O (tonnes)	1A3b i	Road transport - Cars	1.435	1.541	1.613	1.827	1.742	1.439	1.364
	1A3b ii	Road transport - Light duty trucks	0.031	0.032	0.156	0.325	0.410	0.375	0.486
	1A3b iii	Road transport - Heavy duty trucks and buses	0.400	0.324	0.363	0.297	0.432	0.888	1.618
	1A3b iv	Road transport - Motorcycles and mopeds	0.002	0.002	0.002	0.006	0.008	0.008	0.011
		Total	1.868	1.900	2.134	2.455	2.591	2.711	3.478

2.2 Reference approach

The reference approach is a verification approach for the fuel combustion sector recommended by the IPCC and included as a ‘should’ requirement in the UNFCCC reporting guidelines (UNFCCC, 2013). The reference approach is a supply-side calculation based on registered production / import / export and stock changes. The lack of a reference approach for the Faroe Islands also caused differences when combining the inventory for the Kingdom of Denmark, i.e. Denmark, Greenland and the Faroe Islands. This had been noted during international reviews (UNFCCC, 2021) and a recommendation was provided to Denmark to address this issue.

There are only two fuel categories that are relevant in the Faroe Islands: liquid fuels and other fossil fuels. In the first category, gasoline, jet kerosene, other kerosene, residual fuel oil and gas / diesel oil are the relevant fuels and for the latter category, it is waste combustion.

For the liquid fuels, import / export information in units of mass was obtained from the customs authorities. No production is occurring in the Faroe Islands. To convert the activity data from units of mass to units of energy, the net calorific values used in the Faroe Islands were used. These are shown together with the carbon contents in Table 2.5.

Table 2.5 Net calorific value and carbon contents for liquid fuels.

Fuel	Net calorific value, TJ/kt	Carbon content, t/TJ
Gasoline	43.80	19.91
Jet kerosene	43.50	19.64
Other kerosene	43.50	19.61
Gas/diesel oil	42.70	20.18
Residual fuel oil	40.65	21.10

For other fossil fuels, i.e. waste, this is all produced in the Faroe Islands and there is neither import nor export of waste for incineration. The amount reported in the reference approach is therefore identical to values reported in the sectoral approach.

The comparison between the reference approach and the sectoral approach is illustrated in Figure 2.1.

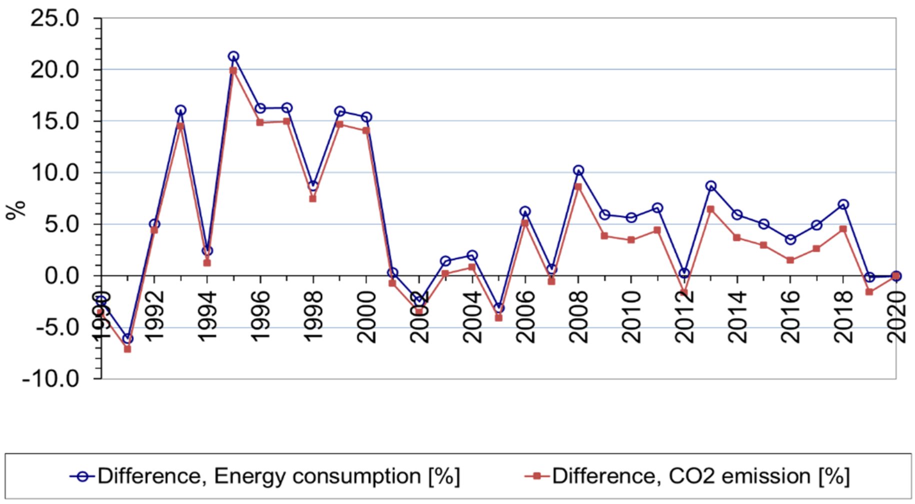

Figure 2.1 Differences observed between the reference and sectoral approach.

It can be seen that the differences are significant, especially for many years in the 1990's. If resources permit in the future, it would be good to look into some of the very large differences and to see if it is possible to reduce the differences or better explain them.

3 Industrial processes and product use

The analysis of the greenhouse gas inventory for industrial processes and product use (IPPU) showed that the inventory only included emissions of fluorinated gases. Most other activities in the IPPU sector are not occurring in the Faroe Islands, i.e. there is no production of mineral, chemical or metal products leading to emissions of greenhouse gases.

Two activities were identified as missing, where default methodologies and emission factors are available from the IPCC Guidelines (IPCC, 2006), namely use of lubricants and use of paraffin wax. This had been noted during the UNFCCC review process (UNFCCC, 2019; UNFCCC, 2021).

3.1 Lubricant use

The IPCC Guidelines (IPCC, 2006) contains a Tier 1 and Tier 2 methodology for estimating emissions from lubricant use. As information is not available to allow distinction between different kinds of lubricants and the emissions are very small, the IPCC Tier 1 methodology is used. Emissions are estimated using Equation 3.1.

$$CO_2 = LC \times CC_{Lubricant} \times ODU_{Lubricant} \times {}^{44}/_{12} \qquad \text{Equation 3.1}$$

Where LC is the total lubricant consumption in TJ, $CC_{Lubricant}$ is the carbon content of the lubricant, $ODU_{Lubricant}$ is the fraction that is oxidized during use and 44/12 is the mass ration of CO_2 to carbon.

The consumption of lubricants is based on information from Hagstova (Statistics Faroe Islands). The IPCC default carbon content of 20 t carbon per TJ is used together with the default net calorific value of 40.2 TJ per kt. The default ODU factor from the IPCC Guidelines is used, i.e. 0.2.

Table 3.1 below shows the consumption and associated CO_2 emissions from lubricant use.

Table 3.1 Consumption and emissions associated with lubricant use.

	1990	1995	2000	2005	2010	2015	2020
Lubricant consumption, kt	1.63	1.65	2.21	2.01	1.53	1.78	1.88
CO_2 emission, kt	0.96	0.97	1.30	1.18	0.90	1.05	1.11

With minor variability between years, the trend is relatively stable. The emission of 1.1 kt in 2020 corresponds to 0.08 % of the national Faroese greenhouse gas emissions.

3.2 Paraffin wax use

The IPCC Guidelines (IPCC, 2006) contains a Tier 1 and Tier 2 methodology for estimating emissions from paraffin wax use. As information is not available to allow distinction between different types of uses of the wax and the emissions are very small, the IPCC Tier 1 methodology is used. Emissions are estimated using Equation 3.2.

$$CO_2 = PW \times CC_{Wax} \times ODU_{Wax} \times {}^{44}/_{12} \qquad \text{Equation 3.2}$$

Where PW is the total wax consumption in TJ, CC_{Wax} is the carbon content of the wax, ODU_{Wax} is the fraction that is oxidized during use and 44/12 is the mass ration of CO_2 to carbon.

The consumption of wax is based on information from Statistics Faroe Islands. The IPCC default carbon content of 20 t carbon per TJ is used together with the default net calorific value of 40.2 TJ per kt. The default ODU factor from the IPCC Guidelines is used, i.e. 0.2.

Table 3.2 shows the consumption and associated CO_2 emissions from paraffin wax use.

Table 3.2 Consumption and emissions associated with paraffin wax use.

	1990	1995	2000	2005	2010	2015	2020
Lubricant consumption, kg	800	992	692	418	362	1003	360
CO_2 emission, kt	0.0005	0.0006	0.0004	0.0002	0.0002	0.0006	0.0002

There are significant fluctuations in the activity data and hence emissions between years. This can probably be attributed to the very small amounts and hence the influence of stock changes between years. The emissions are tiny and the emission of 0.0002 kt in 2020 corresponds to 0.000003 % of the national Faroese greenhouse gas emissions.

4 Agriculture

The agricultural sector at the Faroe Islands is a relatively small contributor to the total greenhouse gas emission, and thus for years 1990 – 2020 the sector accounts for between 2 % and 5 % of the total emission. In the Faroe Islands, only 5-6 % of the total area is cultivated and only 1 % of the Faroese population is today full time farmers. However, it is common in the countryside to keep sheep breeding and cultivate hay. Besides the sheep population, the Faroe Islands also have 1550-2000 cattle and a small population of geese and horses.

Until the 2020 submission, the Faroese emission inventory included methane emission from the animal enteric fermentation process, and emission of methane and nitrous oxide from manure management. Due to the cultivation and fertilization of the agricultural land, the nitrous oxide emission inventory includes emission from grassing animals and from the atmospheric deposition.

During this capacity-building project, the focus was to support a development of a Tier 2 calculation for the sheep and cattle production, which in a better way reflects the agricultural conditions in the Faroe Islands, rather than using the standard Tier 1 emission factors. Due to the cultivated land, the support was focused on including more nitrous oxide emission sources as recommended by the IPCC 2006 Guidelines, e.g. nitrous oxide emission from animal manure applied on soil, use of inorganic fertiliser, crop residue and nitrogen leaching.

Within the project is has not been possible to acquire all the needed data for a Tier 2 calculation or expansion of the nitrous oxide emission sources. However, a calculation Excel sheet is developed to manage all the data, emission factors and calculations used to estimate the greenhouse gas emission from the agricultural sector.

A description of the improvements made during this project is included in the following chapters for each of the main agricultural emission categories; CH_4 and N_2O emission from the livestock production and N_2O from agricultural soils.

4.1 CH_4 and N_2O emission from the livestock production

In the NIR report for Faroe Islands (Nielsen et al., 2021), the improvement chapter mentions two issues, which both was implemented in this project. The first one was related to change from a Tier 1 to a Tier 2 calculation, which is relevant for the main livestock categories, i.e. sheep and cattle. The second issue was to consider other animal categories than cattle and sheep, which are geese and horses.

During the project a calculation spreadsheet was developed, including the following categories; mother sheep, lamb, dairy cattle, other cattle, geese and horses.

4.1.1 Number of animals

Sheep

There are no official requirements for registration of the individual sheep, and there is no slaughterhouse at the Faroe Islands, which is a challenge for estimation of the population. The sheep management is not driven by an intensive production, thus the farmer's slaughter their sheep themselves and the products are used by the farmers themselves or their family members and only a small part of the meat may be sold within the Faroe Islands (Austrheim et al., 2008).

The Agricultural Agency of Faroe Islands estimate that the sheep production includes approximately 80 000 sheep for winter and spring, increasing to 132 500 sheep in total in summer and autumn before slaughtering of lambs. The mother sheep account for 75 000 all year, while the remaining 5 000 in winter and spring is split equal between rams and lambs. The Agricultural Agency estimated the number of lambs to 52 500 in summer and autumn based on the assumption that each mother sheep in average produce 0.7 lamb. This correlation between mother sheep and lamb can also be confirmed in the report on sheep production in the Nordic countries (Austrheim et al., 2008). The Agricultural Agency assumed that 2 500 sheep is kept in housing for the winter, increasing to 6 000 in spring, while the remaining sheep are outside in the field.

The population rate of 80 000 sheep correspond to full extension of the production capacity at the Faroe Islands and no meat is exported.

It is recommended to distinguish the emission calculation between mother sheep and lambs, because of the significant differences in feed intake situation. It can be considered to provide a third sheep category for rams, if data for feed intake and manure management system is available. Alternative, the number of rams can be included in the category of mother sheep.

Table 4.1 Number of sheep at the Faroe Islands.

	Winter	Spring	Summer	Autumn
Mother sheep	75 000	75 000	75 000	75 000
Rams	2 500	2 500	2 500	2 500
Lambs in the autumn and sheep that grazes on grass-covered terraces in bird cliffs	2 500	2 500	2 500	2 500
Lambs	-	-	52 500	52 500
Sheep in housing	2 500	6 000	-	-
Sheep outfield	77 500	74 00	132 500	132 500
Sheep total	80 000	80 000	132 500	132 500

Reference: Jens Ivan í Gerðinum, Búnaðarstovan - the Agricultural Agency of the Faroe Islands.

Dairy cattle and Non-dairy cattle

The number of dairy cattle and non-dairy cattle is based on data from Hagstova Føroya, Statistics of Faroe Islands. The national emission inventory distinguish between dairy cattle and non-dairy cattle (all other cattle).

Table 4.2 Number of cattle at the Faroe Islands.

IPCC code	Livestock category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
3A1	Total cattle	2 070	2 322	2 306	2 135	1 990	1 872	1 826	1 895	1 873	1 801	1 837
3A1a	Dairy cattle	1 040	1 206	1 101	1 048	919	1 113	1 116	1 104	1 115	1 116	1 148
3A1b	Non-Dairy	1 030	1 116	1 205	1 087	1 071	759	710	791	758	685	689

Reference: Hagstova Føroya, Statistics of Faroe Islands.

Geese and horses

No information on the population of geese and horses is given in Statistics of Faroe Islands. Activity data should be collected, e.g. in corporation with the Agricultural Agency of the Faroe Islands.

4.1.2 CH_4 emission from enteric fermentation

The provided calculation sheet includes Tier 1 methodology for geese and horses, because these livestock categories are relatively small and because collection of input data of feed intake can be a challenge. For sheep and cattle a Tier 2 calculation is prepared.

Tier 1 calculation – geese and horses

The emissions for geese and horses are calculated using a Tier 1 methodology, see Figure 4.1 below, which is based on IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use (Equation 10.19).

EQUATION 10.19
ENTERIC FERMENTATION EMISSIONS FROM A LIVESTOCK CATEGORY

$$Emissions = EF_{(T)} \bullet \left(\frac{N_{(T)}}{10^6} \right)$$

Where:

Emissions = methane emissions from Enteric Fermentation, Gg CH_4 yr^{-1}

$EF_{(T)}$ = emission factor for the defined livestock population, kg CH_4 $head^{-1}$ yr^{-1}

$N_{(T)}$ = the number of head of livestock species / category T in the country

T = species/category of livestock

Figure 4.1 Equation for calculation of CH_4 emission from enteric fermentation. Reference; IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.19).

The CH_4 emission factor for horses are given in IPCC 2006 Guidelines Table 10.10, which is 18 kg CH_4 per horse by 550 kg. If Faroese horses are smaller, the emission factor can be scaled proportionally to the weight.

No emission factor for geese or other poultry is mentioned in the IPCC 2006 guidelines. However, an emission factor is included in a study from Taiwan (Wang & Huang, 2005), where the emission is estimated to 0.0015 kg CH_4 per geese per year, based on geese with an average weight of 4 kg. If Faroese geese is different regarding average size, the emission factor can be scaled proportionally to the weight.

Tier 2 calculation – sheep and cattle

The calculation of CH_4 production from the digestive process in animals is based on the total gross energy intake (GE) in feed and the CH_4 conversion factor (Y_m), which is the fraction of gross energy in feed converted to CH_4. The emissions CH_4 is based on IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use (Equation 10.21) – see Figure 4.2.

EQUATION 10.21

CH_4 EMISSION FACTORS FOR ENTERIC FERMENTATION FROM A LIVESTOCK CATEGORY

$$EF = \left[\frac{GE \bullet \left(\frac{Y_m}{100} \right) \bullet 365}{55.65} \right]$$

Where:

EF = emission factor, kg CH_4 head^{-1} yr^{-1}

GE = gross energy intake, MJ head^{-1} day^{-1}

Y_m = methane conversion factor, per cent of gross energy in feed converted to methane

The factor 55.65 (MJ/kg CH_4) is the energy content of methane

Figure 4.2 Equation for calculation of CH_4 emission factor from enteric fermentation. Chapter 10 Emission from livestock and manure management Reference; IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use (Equation 10.21).

Methane conversion factor - Y_m

Table 4.3 lists the Y_m factors recommended by the 2006 IPCC Guidelines.

Table 4.3 Methane conversion factor - Y_m.

Livestock category	Ym, %
Dairy cattle	6.5
Non-Dairy	6.5
Mature sheep	6.5
Lambs	4.5

Reference: IPCC 2006, Table 10.12 and 10.13.

Gross energy intake - GE

To estimate the gross energy intake, two datasets are needed:

- The amount and type of feed intake
- The energy content in the feed

A dialogue with Búnaðarstovan (the Agricultural Agency of the Faroe Island) is in process and some activity have already started, to find data for feed intake for cattle and sheep. For cattle some information can be found in the NorFor system for Iceland (NorFor, 2021) (refer to Appendix 1), which also was mentioned by the Agricultural Agency. The calculation take into account the differences between summer and winter situation, and the data for feed intake can be given in both kg feed or feed units (FU). Table 4.4 shows the input data needed for the type and the amount of feed. However, the numbers have to be considered as an example until the Agricultural Agency has provided the relevant data for the feed situation for sheep and cattle production in the Faroe Islands.

Table 4.4 Input data to calculation of the energy content in feed intake for cattle (example).

Per animal head		Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Summer grassing	Feed unit per month						70	70	70	70	70			350
Winter feeding	kg per month													
Wrap	kg	30	30	30	30	30						30	30	210
Barley pellet	kg	5	5	5	5	5						5	5	35
Rape pellet	kg	1	1	1	1	1						1	1	7
Beet pellet	kg	1	1	1	1	1						1	1	7

The feed intake energy content depends on the feed type and on the composition of proteins, fats and carbohydrates. In Equation 4.1 below is shown the equation for calculation of energy content (MJ) per kg dry matter content. The energy factor for proteins, fats and carbohydrates is estimated based on Danish data (Weisberg & Hvelplund, 1992).

$$MJ/kg\ DM = \%_{crude\ protein} \cdot E_{crude\ protein} + \%_{crude\ fat} \cdot E_{crude\ fat} + \%_{carbohydrates} \cdot E_{carbohydrates} \quad \text{(Eq. 4.1)}$$

Where:

MJ = mega joule

DM = dry matter

$\%_{crude\ protein}$ = share of crude protein in the feed, %

$E_{crude\ protein}$ = energy factor for crude protein, 24.24 MJ per kg DM

$\%_{fat}$ = share of fat in the feed, %

E_{fat} = energy factor for fat, 34.12 MJ per kg DM

$\%_{carbohydrates}$ = share of carbohydrates in the feed, %

$E_{carbohydrates}$ = energy factor for carbohydrates, 17.30 MJ per kg DM

The calculation sheet provided to the Faroe Islands includes values for the energy content for different feed types, and these values are based on the Danish feed table values (Møller et al., 2005). The feed type registered in the calculation sheet may not match the feed types used in the Faroe Islands. If this should be the case, many different feed types are listed in the Danish feed table, and the values can be used in the calculation sheet. If a different composition of the feed type is assumed, the calculation can relative easily be adjusted to the new values.

Preliminary calculation for sheep and cattle until all Tier 2 background data is available

The Agricultural Agency of the Faroe Islands is in process regarding providing data for feed intake for the cattle and sheep production. A first estimate for gross energy (GE) for dairy cattle is estimated to 118 MJ per cow per day, and this estimate is based on the energy demand for maintenance and milk production. This first estimate is used for the inventory submission 2022 and the Faroe Islands plan to do further investigation and make changes if new knowledge have to be taken into account.

Because Faroese data for GE for non-dairy cattle and sheep is not available at present, GE for these categories has been estimated by scaling the values with values used in the Icelandic emission inventory. The scaling is based on the ratio for GE estimate for dairy cattle, and the same ratio is thus used for GE for non-dairy cattle and sheep. Based on this assumption the GE for non-dairy cattle is estimated to 83 MJ per cow per day and for sheep the GE is estimated to 12 MJ per sheep per day.

4.1.3 CH_4 from manure management

To implement a Tier 2 calculation for CH_4 emission from manure management, two data sets, including information on distribution on fertiliser types, are needed:

- The content of volatile solid (organic matter) (VS) in manure
- Allocation on manure management system

Based on this information an average CH_4 emission per animal per year can be estimated based on IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.23) – see Figure 4.3

EQUATION 10.23
CH_4 EMISSION FACTOR FROM MANURE MANAGEMENT

$$EF_{(T)} = \left(VS_{(T)} \bullet 365\right) \bullet \left[B_{o(T)} \bullet 0.67\, kg/m^3 \bullet \sum_{S,k} \frac{MCF_{S,k}}{100} \bullet MS_{(T,S,k)} \right]$$

Where:

$EF_{(T)}$ = annual CH_4 emission factor for livestock category T, kg CH_4 animal^{-1} yr^{-1}

$VS_{(T)}$ = daily volatile solid excreted for livestock category T, kg dry matter animal^{-1} day^{-1}

365 = basis for calculating annual VS production, days yr^{-1}

$B_{o(T)}$ = maximum methane producing capacity for manure produced by livestock category T, m^3 CH_4 kg^{-1} of VS excreted

0.67 = conversion factor of m^3 CH_4 to kilograms CH_4

$MCF_{(S,k)}$ = methane conversion factors for each manure management system S by climate region k, %

$MS_{(T,S,k)}$ = fraction of livestock category T's manure handled using manure management system S in climate region k, dimensionless

Figure 4.3 Equation for calculation of CH_4 emission factor from manure management. Reference; IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.23).

To provide a tier 2 calculation, information on the content of volatile solid (VS) on feed intake, defines as Gross Energy (GE – MJ / head / day) is needed. Besides VS content, the calculation requires values for digestibility of the feed (DE), urine energy (UE) and the ash content in manure (ASH). Based on data mentioned above, the VS can be estimated based on the IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.24) – see Figure 4.4.

EQUATION 10.24
VOLATILE SOLID EXCRETION RATES

$$VS = \left[GE \bullet \left(1 - \frac{DE\%}{100} \right) + (UE \bullet GE) \right] \bullet \left[\left(\frac{1 - ASH}{18.45} \right) \right]$$

Where:

VS = volatile solid excretion per day on a dry-organic matter basis, kg VS day^{-1}

GE = gross energy intake, MJ day^{-1}

DE% = digestibility of the feed in percent (e.g. 60%)

(UE • GE) = urinary energy expressed as fraction of GE. Typically 0.04GE can be considered urinary energy excretion by most ruminants (reduce to 0.02 for ruminants fed with 85% or more grain in the diet or for swine). Use country-specific values where available.

ASH = the ash content of manure calculated as a fraction of the dry matter feed intake (e.g., 0.08 for cattle). Use country-specific values where available.

18.45 = conversion factor for dietary GE per kg of dry matter (MJ kg^{-1}). This value is relatively constant across a wide range of forage and grain-based feeds commonly consumed by livestock.

Figure 4.4 Equation for calculation of VS (volatile solid) excreted in manure. The calculation is based on IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.24).

Table 4.5 shows the values used in the calculation sheet provided to the Faroe Islands. The GE values should be considered as an example. For DE the IPCC default factors are used; 70% for dairy cattle and 60% for non-dairy cattle, mother sheep and lamb. Furthermore, IPCC default factors are used for UE (0.04) and ASH content (8 %) for all animal categories.

Table 4.5 Values used to estimate the volatile solid (VS) in manure.

Livestock category	GE Gross Energy, MJ/head/yr	DE – Digestibility, %	UE - Urinary Energy	Ash, %	VS, kg DM/head/day
Dairy cattle	118	70	0.04	8	2.0
Non-Dairy	83	60	0.04	8	1.8
Mature sheep	12	60	0.04	8	0.3
Lamb	NE	60	0.04	8	NE

The estimate for VS is used as input data for calculation of the CH_4 emission factor from manure management. The emission depends on the manure type, where emission from liquid manure is higher compared to solid manure. For definition of the different manure type, please refer to IPCC 2006 Table 10.18.

Based on values for manure VS content and allocation of manure management systems reflecting the situation in the Faroe Islands, the CH_4 emission factor for manure management can be calculated. Table 4.6 includes the parameters used in the calculation setup provided for dairy cattle, non-dairy cattle and sheep. The values for the methane conversion factor (MCF) and the maximum methane producing capacity (B_o) is based on the IPCC default. The allocation of manure management system is based on information from the Agricultural Agency of the Faroe Islands.

Table 4.6 Parameters used to calculate the average CH_4 emission per animal per year for Dairy cattle, Non-Dairy cattle and Sheep.

	MMS	VS	B_0	MCF	CH_4 EF
Dairy cattle	% allocation	kg dry matter/head/day	M3/kg CH_4/VS excreted	%	Kg CH_4/head/yr
Total	100				
Liquid/slurry	*17*	*2.0*	0.24	17	19.96
Solid storage	*0*	*2.0*	0.24	2	2.35
Dry lot	*0*	*2.0*	0.24	1	1.17
Pasture	*0*	*2.0*	0.24	1	1.17
Daily spread	*0*	*2.0*	0.24	0.1	0.12
Digester	*83*	*2.0*	0.24	10	11.74
Burned for fuel	*0*	*2.0*	0.24	10	11.74
Other	*0*	*2.0*	0.24	1	1.17
CH_4 weighted EF, kg CH_4/head/yr					13.14

	MMS	VS	B_0	MCF	CH_4 EF
Non-Dairy cattle	% allocation	kg dry matter/head/day	M3/kg CH_4/VS excreted	%	Kg CH_4/head/yr
Total	100				
Liquid/slurry	*17*	*1.8*	0.18	17	13.63
Solid storage	*0*	*1.8*	0.18	2	1.60
Dry lot	*0*	*1.8*	0.18	1	0.80
Pasture	*0*	*1.8*	0.18	1	0.80
Daily spread	*0*	*1.8*	0.18	0.1	0.08
Digester	*83*	*1.8*	0.18	10	8.02
Burned for fuel	*0*	*1.8*	0.18	10	8.02
Other	*0*	*1.8*	0.18	1	0.80
CH_4 weighted EF, kg CH_4/head/yr					8.97

	MMS	VS	B_0	MCF	CH_4 EF
Mature sheep	% allocation	kg dry matter/head/day	M^3/kg CH_4/VS excreted	%	Kg CH_4/head/yr
Total	100				
Liquid/slurry	*0*	*0.3*	0.19	17	2.08
Solid storage	*20*	*0.3*	0.19	2	0.24
Dry lot	*0*	*0.3*	0.19	1	0.12
Pasture	*80*	*0.3*	0.19	1	0.12
Daily spread	*0*	*0.3*	0.19	0.1	0.01
Digester	*0*	*0.3*	0.19	10	1.22
Burned for fuel	*0*	*0.3*	0.19	10	1.22
Other	*0*	*0.3*	0.19	1	0.12
CH_4 weighted EF, kg CH_4/head/yr					0.15

4.1.4 N_2O from manure management

The N_2O emission from manure management is divided into direct and indirect emissions. The direct emissions are related to manure depending on the manure type, while the indirect emissions are due to the volatilization of NH_3 and NO_2 (housing and storage), which also leads to N_2O emission. The emission calculations require information on the animals N-excretion in manure and allocation of manure management systems. N_2O emissions from grassing animals are reported in the CRF Table 3D.

Conversion of N_2O–N emissions to N_2O emissions for reporting purposes is performed by using the following equation 4.2:

$N_2O = N_2O\text{–}N * 44/28$ (Eq. 4.2)

4.1.5 Direct N_2O emission

The animal N-excretion is calculated based on the IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.30) – see Figure 4.5.

EQUATION 10.30
ANNUAL N EXCRETION RATES

$$Nex_{(T)} = N_{rate(T)} \bullet \frac{TAM}{1000} \bullet 365$$

Where:

$Nex_{(T)}$ = annual N excretion for livestock category T, kg N animal^{-1} yr^{-1}

$N_{rate(T)}$ = default N excretion rate, kg N (1000 kg animal mass)$^{-1}$ day^{-1} (see Table 10.19)

$TAM_{(T)}$ = typical animal mass for livestock category T, kg animal^{-1}

Figure 4.5 Equation for calculation of annual N-excretion in manure. The calculation is based on IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.30).

Default values from the IPCC 2006 are used for animal weight for cattle (Table 10A.1 and 10A.2) and for horses (Table 10.10). For sheep, the estimate is based on Austrheim et al. (2008), and for geese a weight of 6 kg is used, which refers to Wang & Huang (2005). The weight values can be adjusted in the calculation sheet, if the Faroese conditions is different than assumed. The values for N-rate (kg N excreted per 100 kg animal weight) refer to IPCC 2006 defaults (Table 10.19) for Western Europe.

Table 4.7 Data used in estimating the nitrogen excretion.

	kg N-ex/1000 kg animal weight/day	Animal weight, kg	kg N-ex/head
Dairy cattle	0.48	650	113.88
Non-dairy cattle	0.33	400	48.18
Mature sheep	0.85	45	13.96
Lamb	0.85	36	11.17
Horses	0.26	375	35.59
Geese	0.83	6	1.82

Besides the animals N-excretion, the direct N_2O emission depends on the allocation of manure management systems, because due to the IPCC Guidelines the emissions factors varies between the manure types (2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.25) - see Figure 4.6.

EQUATION 10.25
DIRECT N_2O EMISSIONS FROM MANURE MANAGEMENT

$$N_2O_{D(mm)} = \left[\sum_S \left[\sum_T \left(N_{(T)} \bullet Nex_{(T)} \bullet MS_{(T,S)} \right) \right] \bullet EF_{3(S)} \right] \bullet \frac{44}{28}$$

Where:

$N_2O_{D(mm)}$ = direct N_2O emissions from Manure Management in the country, kg N_2O yr^{-1}

$N_{(T)}$ = number of head of livestock species/category *T* in the country

$Nex_{(T)}$ = annual average N excretion per head of species/category *T* in the country, kg N $animal^{-1}$ yr^{-1}

$MS_{(T,S)}$ = fraction of total annual nitrogen excretion for each livestock species/category *T* that is managed in manure management system *S* in the country, dimensionless

$EF_{3(S)}$ = emission factor for direct N_2O emissions from manure management system *S* in the country, kg N_2O-N/kg N in manure management system *S*

S = manure management system

T = species/category of livestock

44/28 = conversion of $(N_2O\text{-}N)_{(mm)}$ emissions to $N_2O_{(mm)}$ emissions

Figure 4.6 Equation for calculation of N_2O emission from manure management. The calculation is based on IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.25).

In the calculation sheet, the distribution on different manure management systems for cattle reflect the numbers given in IPCC 2006 Table A10-4 and A10-5. For sheep, lamb, horses and geese draft estimates are provided based on expert judgement by the authors. These should be updated based on local knowledge, e.g. in corporation with the Agricultural Agency of the Faroe Islands. The N_2O emission factor for each manure type is based on the IPCC 2006 default, Table 10.21 and Table 11.1 for grazing animals. Note that N_2O for animals on grass is reported in CRF Table 3D (agricultural soils).

4.1.6 Indirect N_2O emission (housing + storage)

The indirect N_2O emission depends on the amount of N, which are volatilities as NH_3 and NO_2 which is based on IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.27) – see Figure 4.7. The volatilization is estimated based on NH_3 and NO_2 emission factors from the EMEP/EEA Guidebook (EEA, 2019) 3B Manure Management, Table 3.2 and Table 3.3, which distinguish between liquid and solid manure.

EQUATION 10.27
INDIRECT N_2O EMISSIONS DUE TO VOLATILISATION OF N FROM MANURE MANAGEMENT

$$N_2O_{G(mm)} = \left(N_{volatilization-MMS} \bullet EF_4 \right) \bullet \frac{44}{28}$$

Where:

$N_2O_{G(mm)}$ = indirect N_2O emissions due to volatilization of N from Manure Management in the country, kg N_2O yr^{-1}

EF_4 = emission factor for N_2O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N_2O-N (kg NH_3-N + NO_x-N volatilised)$^{-1}$; default value is 0.01 kg N_2O-N (kg NH_3-N + NO_x-N volatilised)$^{-1}$, given in Chapter 11, Table 11.3

Figure 4.7 Equation for calculation of direct N_2O emission due to volatilisation of N from manure management. The calculation is based on IPCC 2006, Volume 4 Agriculture, Forestry and Other Land Use, Chapter 10 Emission from livestock and manure management (Equation 10.27).

4.1.7 Calculations used to CRF D – manure applied and animals on grass

Data reported in CRF Table 3D Agricultural soils, requires data for nitrogen applied on agricultural soils and the N_2O emission related to this amount of applied nitrogen. For two emission sources, animal manure applied to soils (3Da2a) and manure deposited by grazing animals (3Da3), data and the emission calculations are handled in the calculation sheet for "N_2O Manure management", because the calculations depends on N-excretion and manure management system.

Furthermore, the emission of NH_3 and NO_2 are estimated in the calculation sheet N_2O Manure management, which are used in the calculation of the indirect N_2O emission in CRF Table 3Db1 (atmospheric deposition). The emission factors for NH_3 and NO_2 are based on the EMEP/EEA Guidebook Chapter 3D Crop production and agricultural soils, Table 3.1. Note, that the calculation take into account a conversion from NH_3 to NH_3-N and from NO_2 to NO_2-N, scaled by the molecular weight.

4.2 N_2O from agricultural soils

All applied N to agricultural soils will lead to emissions of N_2O. The N_2O emissions from cultivation of agricultural soils is divided into two groups, direct and indirect emission. The direct emissions includes sources which are related directly to nitrogen applied on soil, e.g. inorganic fertiliser use or animal manure applied or deposited during grazing, but also includes nitrogen turnover from crop residues. The indirect emission includes N_2O emission from the emission sources where a volatilization of NH_3 and NO_2 take place, which in the CRF Table is defined as the atmospheric deposition. Furthermore, N_2O emission occurs from leaching of N to the groundwater, water streams and the sea.

4.2.1 Direct N_2O emissions

Inorganic fertilisers

To estimate the N_2O emission from use of inorganic fertiliser, information is needed on the nitrogen content in the fertilisers used. Data on import of NPK fertiliser to the Faroe Islands are used, based on information on import from the Faroe Islands agricultural consulting service. Most of the fertilisers are of the type "19-3-13", i.e. with 19 % N (Table 4.8). The decline in use from 2015 is due to a switch to other fertiliser types. These will be included in the future.

The calculation is based on a Tier 1 approach. The N_2O emission factor 0.01 kg N_2O-N/kg N applied is the default value from the IPCC 2006 Table 11.1.

Table 4.8 Import of inorganic fertilisers to the Faroe Islands (kt), 1990, 2000, 2010-2020.

	1990	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Import (kt)	1 097	1 373	1 005	869	966	883	942	856	12	4	2	8	117
19 % N (kt)	208	261	191	165	184	168	179	163	2	1	0	1	22

The emission of NH_3 and NO_2 has to be calculated, because these values are part of the calculation of atmospheric deposition. The emission factors are based on the 2019 EMEP/EEA Guidebook Chapter 3D Table 3.1 of 0.05 kg NH_3/kg N applied and 0.04 kg NO_2/kg N applied, corresponding 0.04 kg NH_3-N/kg N applied and 0.01 kg NO_2-N/kg N applied.

Organic fertilisers

This source includes products used for fertilising the soil, e.g. animal manure, sewage sludge, composted material or other products with nitrogen content.

The amount of N applied in the form of animal manure depends on the livestock category (Table 4.7). The N applied to agricultural soils are nitrogen excreted minus the emission of NH_3, NO_2 and N_2O, which has taken place in housing and storage. The N_2O emission factor is 0.01 kg N_2O-N / kg N applied based on the IPCC default (IPCC 2006, Table 11.1). The calculation of NH_3, NO_2 and N_2O in housing depends on whether the manure is handled as liquid or solid manure, why it is important that accurate data on the allocation of manure management system (MMS) for the situation in the Faroe Islands is collected. In the present calculation, the IPCC default allocation between MMS is used. The emission factor for NH_3 is based on the 2019 EMEP / EEA Guidebook Chapter 3B Table 3.2 and emission factor for NO_2 is based on the 2019 EMEP / EEA Guidebook Chapter 3B Table 3.3.

Bedding material is not included in the calculation. However if bedding products with a nitrogen content is used, this have to be added to the calculation of both the direct emission (N_2O) and the indirect emission from atmospheric deposition (NH_3 and NO_2).

Sewage sludge applied to soils and other organic fertilisers applied to soils

Sewage sludge is not used as fertilisers in the Faroe Islands. Förka is a newly build biogas plant and from 2020, certain areas will be fertilised with digested biomass. For 2020, it is estimated that 8952 tonnes digested biomass is applied to fields, and the N content is estimated to 5.2 kg / tonnes biomass. Most of the digested biomass is animal manure, which accounts for approximately 85 % of the biomass, and the N_2O emission is included in the emission from organic fertilisers. The amount of N in other organic fertiliser applied to soils is thus estimated to 6.9 tonnes N (8952 tonnes x 5.2 kg N x 15 %).

The N_2O emission factor is 0.01 kg N_2O-N / kg N applied based on the IPCC default (IPCC 2006, Table 11.1). The emission of NH_3 and NO_2 from applied sewage sludge and other organic fertiliser have to be estimated, because this source is included in “Atmospheric deposition”. The emission factors for NH_3 and NO_2 are based on default values from the 2019 EMEP / EEA Guidebook Chapter 3D, Table 3.1.

Urine and dung deposited by grazing animals

The N_2O emission from grazing animals is estimated as the total N excreted multiplied by the default N_2O emission factor, which is 0.02 kg N_2O-N / kg N excreted for cattle and 0.01 N_2O-N / kg N excreted for sheep (IPCC Table 11.1).

The emission of NH_3 and NO_2 from grassing animal is included in the emission source “Atmospheric deposition” (3Db1). The NH_3 emission factors used are the default values from the 2019 EMEP / EEA Guidebook Chapter 3B Table 3.2 and the NO_2 emission factor is based on the 2019 EMEP / EEA Guidebook Chapter 3D Table 3.1.

Mineralization/immobilization associated with loss/gain of soil organic matter

The N_2O emission from the mineralization can be considered as a relatively small emission source, because the Faroe Islands has a limited cultivated area, covering only some potato fields and grassing fields. If cultivation of spring wheat is taken place, estimate of N_2O emission have to be included in future emission inventory.

Crop residues

The turnover from nitrogen in crop residues, from roots and leafs, will over time lead to N_2O emission, and the emission depends on the nitrogen content in the crop residue. According to Búnaðarstovan - the Agricultural Agency of the Faroe Islands, the total agricultural area is estimated to 97 800 hectares, mostly grassland and some potato fields between 80 – 116 hectare (FAO Statistics). The calculation of the N_2O emission from crop residues is based on the 2006 IPCC Guidelines methodology, where default values are given for the nitrogen content per amount of dry matter, and the fraction of the dry matter content between the crop residue below and above ground (IPCC 2006, Table 11.2).

Table 4.9 The agricultural area.

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Agricultural area	98 345	98 225	98 121	98 053	97 916	97 831	97 816	97 811	97 811	97 810	97 810
Potato, ha	106	109	107	102	100	97	89	85	82	80	80
Grassland, ha	98 239	98 116	98 014	97 951	97 816	97 734	97 727	97 726	97 729	97 730	97 730

Reference: Total agricultural area; Búnaðarstovan - the Agricultural Agency of the Faroe Islands. Potato; FAO Statistics.

Harvest yield and dry matte fraction for potato and grassland is based on national data from the Agricultural Agency of the Faroe Islands.

For potatoes a yield of 40 tonnes per hectare is assumed. With a dry matter (DM) content of 0.20 kg DM / kg harvest potato, the kg DM content is estimated to approximately 8 000 kg DM / hectare. Calculation by the IPPC methodology and values leads to a nitrogen content of 40 kg N per hectare potato.

For grassland a yield of 22 tonnes per hectare is assumed. For grassland is assumed a yield of 4 840 kg DM per hectare and a dry matter content of 0.22 kg DM / kg harvest grass. Calculation by the IPPC methodology and values leads to a nitrogen content of 82 kg N per hectare grassland.

The default N_2O emission factor of 0.01 kg N_2O-N per kg N in crop residues is used based on the IPCC default (2006 IPCC Table 11.1).

Cultivation of organic soils (i.e. histosols)

The cultivation of organic soils in the Faroe Islands is estimated to vary between 700 – 1100 hectare from 1990-2020, see Table 4.10. The area estimate is based on soil samples taken in 1986 (Búnaðarstovan, 1986), see Table 5.6 in the LULUCF chapter, where 65 % of 296 soil samples were qualified as organic. This percentage has been used for all years for intensive managed grassland. The area estimate data is received from the Faroese Agricultural Agency, Búnaðarstovan (BST). This figure is used in the LULUCF sector as well.

Table 4.10 Area of cultivated organic soils.

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Cultivated organic soils, ha	744	776	870	994	1025	1052	1058	1063	1069	1074	968

A N_2O emission factor of 1.6 kg N2O-N per hectare is used for Grassland, shallow-drained, nutrient-rich from the IPCC Wetland Supplement, Table 2.5 (IPCC, 2014).

4.2.2 Indirect N_2O emissions

Atmospheric deposition

Volatilisation of NH_3 and NO_2 and the deposition of these gases and products onto soils and the surface of lakes and other water bodies cause N_2O emission. Emission of N_2O is calculated based on:

- all NH_3 emission sources; manure applied to soil, inorganic N fertiliser, other organic fertilisers, grazing animals
- all NO_2 emission sources; manure applied to soil, inorganic N fertiliser and other organic fertilisers.

The N_2O emission factor (EF), 0.01 kg N_2O-N per kg NH_3 and NO_2 volatilised, is based on the IPPC default (IPCC 2006, Table 11.3).

Table 4.11 Calculation of N_2O emission from atmospheric deposition.

kg N volatilised as NH_3-N and NO_2-N	1990	1995	2000	2005	2010	2015	2020
Inorganic N fertilisers	11 119	11 040	13 916	14 942	10 187	8 675	1 186
Animal manure applied to soils (application)	56 065	58 769	57 734	56 444	54 583	55 801	55 956
Urine and dung deposited by grazing animals	70 104	70 104	70 104	70 104	70 104	70 104	70 104
Sewage sludge applied to soils	0	0	0	0	0	0	0
Other organic fertiliser	0	0	0	0	0	0	1
Total kg N volatilised as NH_3-N and NO_2-N	137 288	139 913	141 754	141 490	134 873	134 579	127 246
N_2O EF kg N_2O-N/kg NH_3–N + NO_2–N volatilised	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Emission, kt N_2O	0.00216	0.00220	0.00223	0.00222	0.00212	0.00211	0.00200

Nitrogen leaching and run-off

The emission of N_2O from N-leaching and runoff is calculated based on the total amount of N applied to the agricultural soils, multiplied with the share of the N amount which is expected to be lost to leaching and runoff (FracLeach) multiplied with the N_2O emission factor. The N applied is the sum of all sources which contribute to the N application as shown in Table 11. The calculation uses the IPCC default for FracLeach, which is 0.3 kg N / kg N applied (IPCC Table 11.3). The IPCC default is also used regarding the N_2O emission factor, 0.0075 kg N_2O–N / kg N leaching / runoff (IPCC Table 11.3).

Table 4.12 The calculation of N_2O emission from N-leaching and runoff.

	kg N applied in 2020
N applied from inorganic fertiliser	22 231
N applied from animal manure applied	1 822 624
N applied from sewage sludge	0
N applied from other organic fertiliser	7
N applied from animal on grass	1 481 146
N applied from crop residue	8 034 955
N applied from mineralization	0
N applied total	11 360 963
Fra cLeach, kg N/ kg N applied (IPCC default)	0.3
N-leached and run-off	3 408 289
kg N_2O–N/kg N leaching/runoff (IPCC default)	0.0075
Emission, kt N_2O	0.402

5 Land use, land-use change and forestry

Until the 2021 submission, the Faroese greenhouse gas inventory submitted to UNFCCC has not included emission estimates for the land use sector, Land Use, Land Use Change and Forestry (LULUCF).

This is the first LULUCF inventory for the Faroe Islands. The inventory is compiled by the Danish Inventory team with auxiliary data received from the Umhvørvisstovan (US), the Faroese Environmental Protection Agency and from Búnaðarstovan (BST), the Agricultural Agency of the Faroe Islands.

The Danish Inventory team has:

- Created a full set of LULUCF reporting tables for the reporting years 1990 to 2020 in UNFCCCs reporting database, CRF-reporter, ensuring that reported emissions are included in the reported total emission from the Faroese territory
- Filled in, based on our best knowledge on the Faroese conditions:
  - Information on methodology used, Tier 1 – Tier 3
  - Information on used emission factors, EF
  - Used recommended data, models and Notation Keys (NK) from the IPCC 2006 Guidelines reporting guidelines and the IPCC 2013 Wetlands Supplement
  - Implemented a Danish developed model for biomass in wooded vegetation
- Created a complete Land Use Matrix from 1990 to 2020
  - based on the best available information
  - with a subdivision into Land remaining Land and Land converted to "x" with a transition time of 20 years, which is the default transition time in the IPCC 2006 reporting guidelines
- Estimated annual emissions from the six land use categories as requested by UNFCCC according to the IPCC 2006 Guidelines (IPCC, 2006) and the IPCC 2013 Wetlands Supplement (IPCC, 2014). The six land use categories includes
  - Forest land
  - Cropland
  - Grassland
  - Wetlands
  - Settlement
  - Other land
- Estimated the annual N_2O emission from organic soils from Cropland and Grassland to be reported in the agricultural sector (Section 5, Agriculture, CRF-table Table 3.D.a.6) which is currently lacking
- In Excel created an input-data spreadsheet, which can be used for the future reporting. The spreadsheet is minimized to only account for the most important land use changes occurring in the Faroe Islands
- Made quality assurance / quality control (QA / QC) of the calculation
- Made a description of the data and methodologies which will be used as chapter for the LULUCF reporting in the Faroese inventory report, which is a separate chapter in the Kingdom of Denmark's National Inventory Report submitted to UNFCCC
- Created simple uncertainty analysis tables for inclusion in the inventory submission

- Several on-line meetings has been made with the Faroese inventory team as well as a visit to the Faroe Islands was made in July 2021 to facilitate the development of the reporting
- As an add-on the work done has provided updated information on forest area and carbon stock, which can be used for future reporting on the status of the forest on the Faroe Islands to FAOs "Global Forest Resources Assessments (FRA)", https://www.fao.org/3/ca9996en/ca9996en.pdf

5.1 State of Art

A LULUCF inventory has several demands for data collection. Data, which often are beyond the data availability in many countries. This is also the case in the Faroe Islands. The major backbone in a LULUCF inventory is a land use matrix where a country is subdivided in six land use categories according to the IPCC 2006 Guidelines (IPCC, 2006). The IPCC definitions of these categories often differ from how land areas are defined in a country.

Three examples:

- In the case of the Faroe Islands where Forestry is more or less absent, there has previously not been a need to define the forest area. Nevertheless, it is obligatory to define forest for reporting purposes, so in the process for creating the inventory, the Faroe Islands had to make a definition of forest. In the process, the Faroe Islands has made a country specific forest definition for its territory
- The area with settlements include built-up areas, roads etc. In the Faroe Islands only houses are registered in the cadastral maps whereas streets in urban areas are not included, as well as roads in the open land is defined as lines. Therefore, the Faroese inventory team had to create a map for settlements, which included marked house parcels and likely areas between the parcels and convert road lines into areas by introducing a road width to get the Settlement area
- To facilitate the reporting with a division of land into different land use categories with a transition time of 20 years, data on area development has to go 20 years back from the first reporting year, which is 1990, i.e. back to 1970. Therefore, it was needed to extrapolate datasets for the likely area allocation back to 1970. Such data are scarce in the Faroe Islands. As land use changes in the Faroe Islands is limited and carbon stock in the different land use categories are limited, the uncertainty on the extrapolation has only a very small impact on the emission estimates in the LULUCF inventory.

In the development of the Faroese LULUCF inventory, several assumptions has been made, which can be further qualified in the continuous improvements of the inventory. However, it is considered that the developed LULUCF inventory is of sufficient quality and that it accurately represents the circumstances in the Faroe Islands.

Special thanks are given to the Faroese team at Umhvørvisstovan (US), especially Maria Gunnleivsdóttir Hansen, Stein Fossá and Hans Olof Engberg, and to Jens Ivan í Gerðinum from Búnaðarstovan (BST).

5.2 LULUCF in the Faroe Islands

The Faroe Islands are located in the Atlantic Ocean between Great Britain and Iceland with the capitol, Tórshavn, on 62.01°N and -6.87°E. The Faroe Islands consist of 18 islands, in total 1394 km^2 (app. 36*36 km^2). The islands are rocky where perennial grass is the dominating plant cover. The highest point, Slættaratindur, translated as "flat summit", is the highest mountain in the Faroe Islands, towering at 880 meters.

The climate is cold and wet with an annual average temperature of 7 °C (1991-2020). Due to its position in the Atlantic Ocean and the Gulf Stream, there is only a small variation in the temperatures between winter and summer (DMI, 2021). The mean winter temperature is around 4 °C and the mean summer temperature is around 11 °C, Figure 5.1, which according to the IPCC 2006 Guidelines classification is "Cool Temperate Moist." The annual precipitation is high and around 1400 mm per year with most rain in the autumn, November to January.

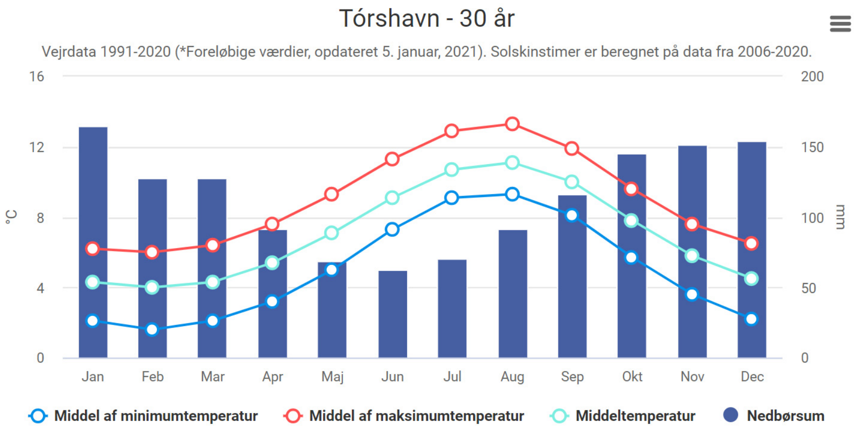

Figure 5.1 Average climate data for Tórshavn in the Faroe Islands, 1991-2020 (DMI, 2021, https://www.dmi.dk/vejrarkiv/normaler-faroerne/).

Due to the rather cold climate and grazing sheep (see the agricultural sector, 3.A) perennial wooden plants are seldom occurring. Minor areas with primarily pine (*Pinus spp.*) can be found in protected areas. To facilitate and protect wooden crops/afforestation the Faroe Islands has many years ago implemented protection of some areas with fencing and included these in the legislation. In Faroese, "Skógfriðing." The mild climate facilitate year around grazing, where the sheep are excluded from designated high value grassland areas (indmark, bøur). During the winter period, the sheep are allowed to graze in these more fertile areas, which cover around 6 % of the total Grassland area. Grassland or "hagi" in Faroese, where sheep are roaming, is unfertilized and with medium to sparse grass vegetation where the rocky underground is approaching the surface.

5.3 Land Use Matrix

The land use matrix is based on the best available data. The Faroe Islands has been grazed for the last 1000 years and annual agricultural crops is limited due to the low temperatures. Therefore, the dominating land use is grassland with only minor changes over time and mainly to Settlement such as houses and infrastructure. Over the past decades, more permanent grassland has been established to improve the grass quality, but remains limited.

A new national forest definition has been defined for the purpose of the reporting to UNFCCC.

A GIS analysis was performed in 2021 (Umhvørvisstovan, 2021) to establish a classification of the six IPCC land use classes defined as per 31 December 2020. The GIS analysis was submitted to Aarhus University. As the Faroe Islands are not fully matriculated and roads are only lines on a map, GIS analyses were performed to achieve area estimates. The outcome per 31 December 2020 is shown in Table 5.1. Forest covers only 34.7 ha, Grassland 70 % of the area, Settlements 1.5 % and Other Land 27 %. Other land consists of barren land such as rocks and stone.

Table 5.1 Area estimates and changes in hectares for the six IPCC land use classes from 1. January 1990 to 31. December 2020.

1990\2020	Forest	Cropland	Grassland	Wetlands	Settlements	Other	Sum
Forest	28.3	0	0	0	0	0	28
Cropland	0	0	0	0	0	0	0
Grassland	6.3	3	97804	0	276	0	98090
Wetlands	0	0	0	2037	0	0	2037
Settlements	0	0	0	0	1722	0	1722
Other	0	0	3	0	92	37629	37724
Sum	34.7	3	97807	2037	2090	37629	139600
Percentage	0.0%	0.0%	70.1%	1.5%	1.5%	27.0%	100.0%

The forest area has been estimated to 34.7 ha, cropland to 3 ha, grassland to 97 807 ha, wetlands to 2037 ha, settlements to 2090 ha and other land to 37629 ha. The Faroe Islands is using a 20-year transition period in the UNFCCC reporting as recommended by IPCC (IPCC, 2006). To achieve this combined with a full reporting from 1990, the land use matrix has been extrapolated back to 1971 based on existing data and expert judgments. However, for land converted to Settlements a GIS analyse has been performed including information on road constructions. Conversion of Grassland to Cropland is based on expert judgment. Afforestation is based on information from Umhvørvisstovan (Umhvørvisstovan, 2021).

5.4 Total emission from the LULUCF sector

The total emission from the LULUCF sector on the Faroe Islands has been estimated to 34.9 kt CO_2 eqv. (Table 5.2). The emission is primarily due to emissions from drained organic grassland. Forests are a minor sink in the Faroe Islands. Cropland consists of only a few hectares in 2020 and no emissions have been reported from here as well as from managed Wetlands. Settlements are reported as a minor source due to clearance of living biomass when housing and roads are established on Grassland.

Table 5.2 Total emissions from the LULUCF sector, kt CO_2 equivalents.

	1990	2000	2010	2015	2016	2017	2018	2019	2020
A. Forest land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Cropland	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Grassland	33.97	34.51	35.15	35.27	35.29	35.32	35.34	35.36	34.91
D. Wetlands	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Settlements	0.05	0.05	0.09	0.05	0.05	0.00	0.00	0.00	0.00
F. Other land	NA	NA	NA	NA	NA	NA	NA	NA	NA
G. Harvested wood products	NE	NE	NE	NE	NE	NE	NE	NE	NE
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry	34.02	34.56	35.24	35.32	35.34	35.32	35.34	35.36	34.91

5.5 Forest land

The area with forest in the Faroe Islands is very limited. For the purpose of reporting, the Faroe Islands has made the following forest definition.

- All areas which are protected by a forest reserve declaration
- Other not protected areas with forest / woody vegetation excluding minor areas:
  - Some areas within Settlements like Sjómanskúlatrøðin, Mullerstrøð and Debesartrøð
  - Areas which are part of nurseries (Gróðurstøðin)
  - Some private areas like Viðarlundin í Sortudýki

Per 31 December 2020, the total estimated forested area was 34.7 ha. For estimating the actual carbon stock and due to the sparse vegetation, a Danish developed model for hedges is used, where the carbon stock estimation is based on vegetation volume, which is converted to carbon. It is not assumed that forest growth takes place on organic soils. Area and emissions from organic forest soils is hence reported as Not Occurring (NO). By default no changes is assumed to occur in the soil organic carbon pool (IPCC, 2006), both for Forest Land remaining Forest Land and for land converted to Forest Land. Deforestation do not occur in the Faroe Islands. No dead wood can be found in the small areas with trees and therefore NO is reported. The same is the case for litter.

5.5.1 FL remaining FL and Land converted to FL

The total Forest area has by the end of 2020 been estimated to 34.7 hectare. This is based on GIS analysis made by Umhvørvisstovan in 2021. The total forest area consist of 76 individual forest parcels, each being assigned a planting year with the earliest planting in 1914.

Figure 5.2 Successful afforestation near Tórshavn (left), partly successful afforestation near Tórshavn (middle) and unsuccessful afforestation near the village Kirkjubøur on the Faroe Islands.
(Photo: Steen Gyldenkærne, Aarhus University, Denmark).

For the purpose of estimating the carbon stock, all parcels have been assigned a plant cover and plant height in 1970, 1990, 2010 and 2021. Height at planting has been set to 0.5 meter as default. For intervening years, a linear interpolation of plant cover and plant height has been made to estimate the canopy volume. The canopy volume has been converted to biomass with a conversion factor of 2.538 kg dry matter biomass per m^3 canopy (Levin et al. 2020), a carbon content of 0.48 and a root:shoot factor of 0.192 (IPCC, 2006). The CH_4 and N_2O emission factors are IPCC default values taken from the Wetlands supplement (IPCC, 2013). For conversion to CO_2 equivalents the conversion factors (global warming potentials with a time horizon of 100 years) currently adopted for reporting to the UNFCCC is used. These are 25 for CH_4 and 298 for N_2O (UNFCCC, 2013). Conversion of N_2O-N to N_2O is made by multiplication with the molecular weight, i.e. 44 / 28.

Table 5.3 Parameters used to estimate emissions from forests. No changes in mineral soils are expected.

	Above ground kg dry matter per m^{-3} canopy	Root:Shoot, fraction	C fraction	C loss organic soils, kg C ha^{-1} yr^{-1}	CH_4 emission organic soils, kg CH_4 ha^{-1} yr^{-1}	N_2O-N emission organic soils, kg N_2O-N ha^{-1} yr^{-1}
4.A. Forest land	2.538	0.192	0.48	NA	7	NA

Table 5.4 Parameters used to estimate emissions from land uses (ex. Forestry). No changes in mineral soils are expected.

	Dry matter stock, Above ground biomass, kg DM ha^{-1}	Total dry matter stock, kg DM ha^{-1}	Root:Shoot, fraction	C-content, kg C kg^{-1} OM, fraction	C loss organic soils, kg C ha^{-1} yr^{-1}	CH_4 emission organic soils, kg CH_4 ha^{-1} yr^{-1} organic soils	N_2O-N emission organic soils, kg N_2O-N ha^{-1} yr^{-1}
4.B.1.1 Cropland, Annual crops	2400	13600	0.24	0.48	-3600	1.4	1.6
4.C.1.1. Grassland, Intensive Managed	2400	13600	0.24	0.48	-3600	1.4	1.6
4.C.1.2. Grassland, Slightly Managed	1200	6800	0.24	0.48	-1800	0.7	0.8
4.C.1.3 Grassland, Unmanaged, where sheep roam	240	1360	0.24	0.48	0	0	0
4.D.1.1 Wetlands, Lakes and Streams	NE	NE	NE	NE	NE	NE	NE
4.D.1.2 Wetlands, Bogs and Swamps	NE	NE	NE	NE	NE	NE	NE
4.E. Settlement	600	3400	0.24	0.48	NA	NA	NA
4.F. Other land	NO	NO	NO	NO	NA	NA	NA

When land use conversion is taking place the standing stock of living biomass on the afforested area is removed. In the case of the Faroe Islands, afforestation is only taking place on fertile grassland. Table 5.5 shows the estimated areas and emissions / removals from forestry in the Faroe Islands.

Table 5.5 Estimated forest area and emissions/removals from the forests. Emissions are positive (+) and removals are negative (-).

Forest land	1990	2000	2010	2015	2018	2019	2020
Forest Land remaining Forest Land, ha	20.30	28.35	34.07	34.07	34.07	34.07	34.49
Emission, kt CO_2	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Land converted to Forest land, ha	13.78	6.14	0.42	0.42	0.58	0.58	0.16
Emission, kt CO_2	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
Forest area, total, ha	34.07	34.49	34.49	34.49	34.66	34.66	34.66
Emissions, total, kt CO_2	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001	-0.001

No N_2O and CH_4 emissions have been estimated from the unfertilized forests.

5.6 Cropland

The climate in the Faroe Islands is not suitable for annual crops. Only three hectares are reported with annual crops, primarily potatoes and spring wheat. It is assumed that all three hectares are grown on mineral soils and that no changes in the soil carbon stock occur due to its very marginal cultivation, dominantly with potatoes.

No emissions are assumed from living biomass except during land use conversion. Default parameters for living biomass in the six different land use classes are shown in Table 5.4.

The total area of cropland remaining cropland has been estimated to zero hectares in 1990 and increased to three hectares in 2020. No changes in the carbon stock is assumed in living biomass and in mineral soils. The default carbon stock on Cropland is assumed to be the same as for Grassland (IPCC, 2006). Despite the fact that the three hectares was first reported in 2006, all Cropland is reported under Cropland remaining Cropland.

In 1986, a thorough soil sampling was made on improved grassland in the Faroe Islands on all islands. In total 296 soil samples were taken, see Table 5.6 (Búnaðarstovan, 1986). Soil sampling depth was approximately 20 cm (Jens Ivan í Gerðinum, BST, personal communication).

Table 5.6 Result of soil sampling on the most fertile grassland in 1986 (Data from Búnaðarstovan, 2021).

	No of Samples	% distribution	Average % OM	Average bulk density, g cm^{-3}
>= 20 % OM	193	65 %	27.9	0.5
<20 % OM	103	35 %	14.1	0.7
Total	296	100 %	22.9	0.59

Organic soils are identified on the basis of criteria 1 and 2, or 1 and 3 listed below:

1. Thickness of organic horizon greater than or equal to 10 cm. A horizon of less than 20 cm must have 12 percent or more organic carbon when mixed to a depth of 20 cm.
2. Soils that are never saturated with water for more than a few days must contain more than 20 percent organic carbon by weight (i.e., about 35 percent organic matter).
3. Soils are subject to water saturation episodes and have either:
   - At least 12 percent organic carbon by weight (i.e., about 20 percent organic matter) if the soil has no clay; or
   - At least 18 percent organic carbon by weight (i.e., about 30 percent organic matter) if the soil has 60% or more clay; or
   - An intermediate, proportional amount of organic carbon for intermediate amounts of clay.

All other types of soils are classified as mineral. As can be seen from Table 5.6 65 % of 296 soil samples have an Organic Matter (OM) content of 20 % or higher, which qualify them as organic soils according to IPCC (2006). The soils are quite acidic with an average pH of 4.9 (Búnaðarstovan, 2021). For the three hectares of cropland, it is assumed that they are all located on mineral soils.

Although part of the cropland may contain some organic matter it is difficult to classify these as organic in terms of the IPCC guidelines (IPCC, 2006; IPCC, 2014) as many of them do not fulfil the FAO soil classification as having a depth of > 20 cm.

5.7 Grassland and land converted to grassland

Grassland on the Faroe Islands is divided into three categories: intensive managed grassland, slightly managed grassland and unmanaged grassland, where sheep is roaming. Intensive managed grassland has been estimated to around 1000 hectares, slightly managed to 6000 hectares and grassland where sheep is roaming to about 90 000 ha, see Table 5.7 . The marginal roaming grassland is called “hagi.” The sheep may also roam on Other Land. In total 97 807 ha is classified as grassland in 2020.

Animal manure and fertilization may take place on the intensive and slightly managed grassland. The difference between intensive managed grassland and slightly managed is that on the intensive managed grassland, stone has been removed and new seeding of grass has been made. This occurs maybe with an interval of 30-50 years and is subsidized, see Figure 5.3. The slightly managed grassland has not been tilled and only slightly ditched (see Figure 5.3). For reporting purposes, an emission factor of 50 % of the intensive managed soils has been selected for slightly managed grassland.

Figure 5.3 Grassland turned into Intensive Managed Grassland (left), Ditch drained Grassland (middle), slightly managed Grassland (right) on the Faroe Islands (Photo: Steen Gyldenkærne, Aarhus University, Denmark).

For grassland, it is assumed that 65 % is on organic soils and 35 % on mineral soils based on the soil sampling made in 1986, Table 5.6.

The unmanaged marginal grassland is rocky and with a shallow soil layer. Very little data on the soils are available.

For intensive managed organic grassland soils an annual emission of 3.6 tonnes C ha^{-1}, a CH_4 emission factor of 1.4 kg CH_4 ha^{-1} yr^{-1} and a N_2O emission factor of 1.6 kg N_2O-N ha^{-1} yr^{-1} is assumed (IPCC, 2014) due to the presumable shallow layers combined with high precipitation rates leaving quite wet soils. Slightly managed grassland is assumed to have an emission of 50 % of the intensive managed grassland for CO_2, CH_4 and N_2O. It is assumed that none of the marginal grassland qualifies as being organic. In the reporting, all unmanaged grassland is thus reported as being on mineral soils with no changes in the amount of living biomass and soil carbon stock.

As the Faroe Islands are hilly, no cropland or grassland areas occurs with stagnant water. Thus, the CH_4 emission from ditches is not likely and hence no CH_4 emission from ditches are reported. No estimates has been made for dissolved organic matter (DOC), which is therefore reported as NE.

Table 5.7 shows the estimated areas and emissions from all grassland in the Faroe Islands. In 2020, it is estimated that 4648 hectares of organic soils emit greenhouse gases. The total emission has been estimated to 36.9 kt CO_2 equivalents of which 0.007 kt N_2O (2.0 kt CO_2 equivalents) is reported in the agricultural sector in the CRF Table 3.D under 3.D.a.6.

Table 5.7 Area with Grassland and estimated emissions.

	1990	2000	2010	2015	2018	2019	2020
Grassland Land, total, ha	98075	97965	97854	97814	97808	97807	97807
Grassland, Managed, ha	744	870	1022	1049	1066	1071	965
Grassland, Unmanaged, ha	6409	6283	6129	6101	6085	6079	6185
Grassland Land, mineral soils, ha	93426	93315	93206	93166	93160	93160	93159
Grassland Land, organic soils, ha	4650	4650	4648	4648	4648	4648	4648
Emission, kt CO_2-C	9.240	9.387	9.561	9.593	9.612	9.619	9.495
Emission, kt CH_4	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Emission, kt N_2O (reported under Agriculture)	0.006	0.007	0.007	0.007	0.007	0.007	0.007
Emission, kt CO_2-eqv.	35.892	36.465	37.140	37.265	37.340	37.365	36.883

5.8 Wetlands

Based on the most recent GIS analysis performed by Umhvørvisstovan in 2021, Wetlands on the Faroe Islands consist of 1749 ha flooded land (inland lakes and streams) and 287 ha partly flooded land such as swamps, in total 2037 ha. The occurring wetlands are reported as unmanaged although some of the flooded land is water reservoirs for drinking water. No peat extraction is taking place on swamp areas.

No changes in the area with wetlands is reported and no emissions are reported from wetlands.

5.9 Settlements and land converted to settlements

Settlement consist of built-up areas, roads and quarries. A GIS analysis performed in 2021 has estimated the area with built-up areas to 1823 hectare and roads and quarries to 267 hectare.

The area with settlements has been estimated to 1722 hectares in 1990 increasing to 2090 hectares in 2020. New dwellings are mainly taking place on former grassland whereas road construction takes place both on Grassland and Other Land. It is assumed that 75 % of the new settlements are conversion of Grassland and the remaining 25 % is conversion of Other land.

The GIS analysis performed in 2021 has also analysed road constructions and in this work, the many tunnel constructions have been excluded from the land use change.

For Other Land converted to Settlement no changes in the carbon stock in all reported carbon pools are assumed. For Grassland converted to Settlement it is assumed that conversion from slightly managed grassland to settlements have a default of 50 % in living biomass of slightly managed grassland. No changes in soil carbon stock is assumed. This due to both the likely very thin layer of soil above the rock combined with the cold and wet climate, which reduces the turnover of organic matter. It is thus assumed that the recommendation of an 80 % value of the original carbon stock in grassland in paved areas (IPCC, 2006, Chapter 8, Settlements, page 8.24) is not applicable for Faroese conditions.

5.10 Other Land

The GIS analysis has estimated the total Other Land area to 37629 hectare. From 1990 to 2020, the area has decreased due to road constructions and new dwellings. By definition Other Land do not have any carbon stock.

6 Waste

Emissions associated with the waste sector as defined by the IPCC were not included in the Faroese greenhouse gas inventory until the 2021 submission. This has been the subject of recommendations during the UNFCCC review process (UNFCCC, 2019; UNFCCC, 2021). The waste sector comprises of four main subsectors. There are two waste incineration plants on the Faroe Islands, one in Hoyvík and one in Leirvík. Both plants perform energy recovery operations and therefore the emissions from the plants are allocated to the energy sector (Public Electricity and Heat Production, 1A1a) in accordance with the IPCC Guidelines. The emissions from this activity has always been included in the Faroese inventory. The remaining three subsectors are described below.

6.1 Solid waste disposal on land

Several land-based solid waste disposals facilities are located and operating in the Faroe Islands. All solid waste disposal sites are considered to be managed.

In estimating emissions, the first order decay model included in the 2006 IPCC Guidelines (IPCC, 2006) has been used. The activity data (amounts and types of waste) are based on data and expert judgement from the Faroe Islands. For DOC (degradable organic carbon), DOCf, MCF (methane conversion factor) and T½ (half-life), the default values from the 2006 IPCC Guidelines are used. The Faroese climate is considered as wet and temperate. Most of the landfilled waste are inert materials, as combustible waste generally is incinerated and in prior times discarded directly into the sea. In 2020, the composition of the landfilled waste is assumed to be 70 % inert materials, 20 % sludge and 10 % garden waste.

The CH_4 emission associated with solid waste disposal on land amounts to 0.14 kt in 2020 or 3.5 kt CO_2 equivalents. This corresponds to approximately 0.25 % of the total Faroese greenhouse gas emission in 2020. The trend in emission is shown in Figure 6.1.

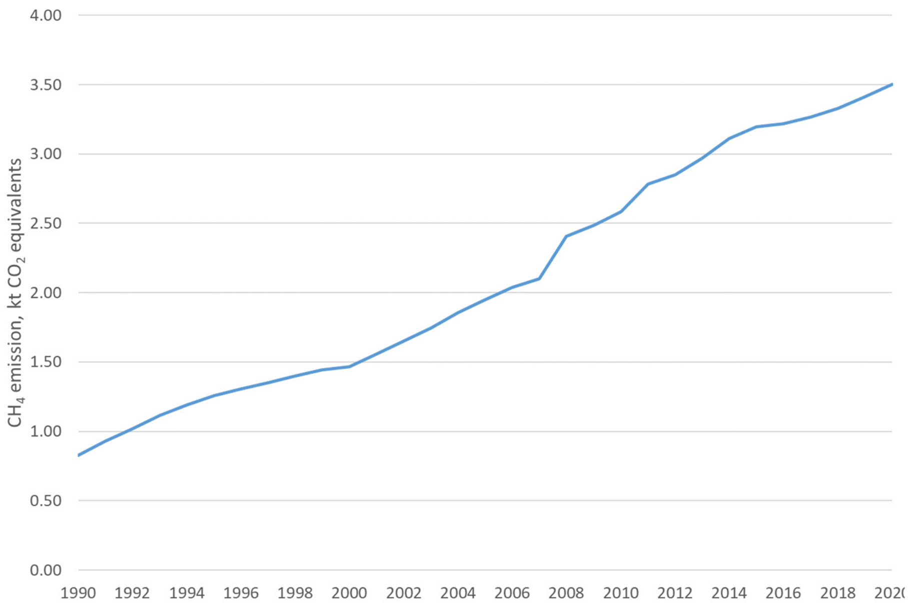

Figure 6.1 Trend in CH_4 emissions from solid waste disposal from 1990 to 2020.

The increasing trend is caused mainly by an increase in the deposited amounts of garden waste.

6.2 Biological treatment of solid waste

The first biogas facility in the Faroe Islands, FORKA, did open in Hoyvík in 2020. FORKA primarily receive organic waste from the aquaculture industry and from agriculture. As data was not yet available, it was not possible to include this in the inventory. The IPCC default assumption is that the emission associated with the production is 5 % of the produced methane. Therefore, when the data for the amount of biogas produced are available it can be included in the inventory.

Composting in the Faroe Islands is primarily a small-scale activity in private households only, wherefore activity data are unknown and as the source is very small it can be considered negligible. In recent years though, some Faroese municipalities are about to establish compost sites where people can deliver their organic household waste, e.g. the municipality of Vágur in Suðuroy. When data become available, this should be included in the inventory using the default emission factors from the 2006 IPCC Guidelines (IPCC, 2006), which are 4 g CH_4 per kg wet waste and 0.24 g N_2O per kg wet waste.

6.3 Wastewater treatment and discharge

In the Faroe Islands, many households have a septic tank through which domestic wastewater (sewage) flows for basic mechanical treatment. Industrial wastewater, e.g. from the fishing industry, is treated mechanically (oil / fat separation). Only a very few wastewater handling plants are treating the wastewater chemically and / or biologically.

For CH_4 emissions from domestic wastewater, the TOW (total organics in wastewater) is estimated based on the population and the default value for BOD (biological oxygen demand) of 62 gram per person per day, the default value for additional industrial BOD discharged to sewers (1.25) and the B0 default value (0.6 kg CH_4 per kg BOD). MCF values used are the IPCC default values. The pathways for the wastewater are based on expert judgement and are under review. Presently, it is assumed that 50 % of the wastewater is treated aerobically in plants, 40 % of the wastewater is treated in septic systems and the remaining 10 % is discharged directly into the sea. There are no anaerobic wastewater treatment systems in the Faroe Islands.

For industrial wastewater, only a few industries have separate wastewater treatment, especially the fishing industry. All treatment is done in aerobic plants and since the default MCF value is zero, there are no emissions reported from industrial wastewater treatment.

The N_2O emission is estimated both for the effluents and for the plants. As mentioned above, it is assumed that 50 % of the wastewater is treated in modern plants. The default EF of 3.2 g N_2O per person is used. For the N_2O from effluents, the emission is calculated based on the population, protein consumption data for Denmark and on default values for fraction of nitrogen in protein, factor for non-consumed protein added to the wastewater, and factor for industrial and commercial co-discharged protein into the sewer system. The EF is the IPCC default of 0.005 kg N_2O-N per kg N.

The CH_4 emission from wastewater treatment is estimated to be 0.19 kt and the N_2O emission is estimated to be 0.01 kt in 2020. In CO_2 equivalents, the emissions are 4.6 and 1.5 kt, respectively. The total emission from wastewater treatment of 6.1 kt CO_2 equivalents corresponds to a little over 0.4 % of the total Faroese greenhouse gas emissions. The trend in emission is shown in Figure 6.2.

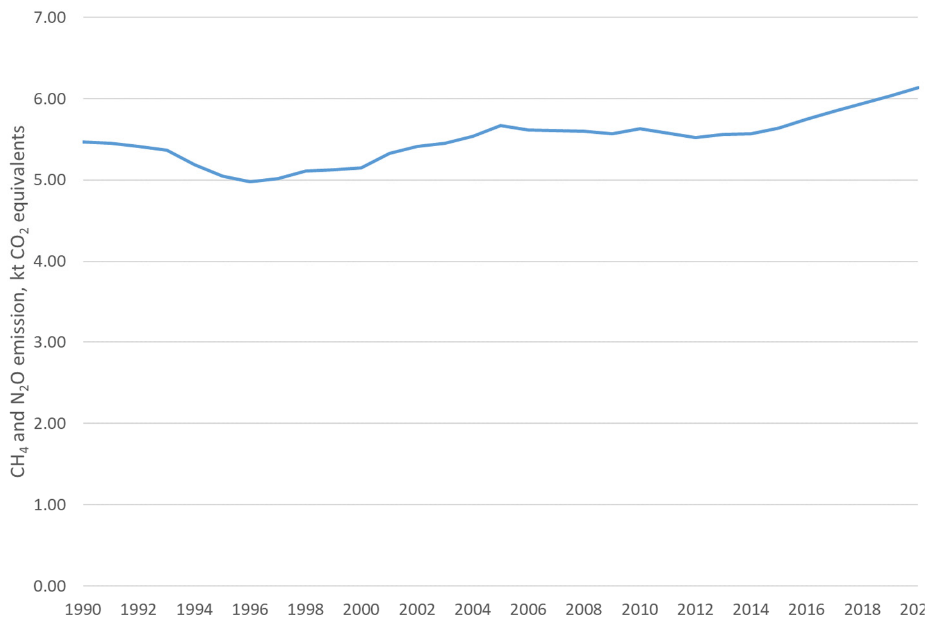

Figure 6.2 Trend in greenhouse gas emissions from Wastewater treatment and discharge from 1990 to 2020.

The trend is following closely the trend in the population.

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Appendix 1 Norfor – Nordic Feed Evaluation System (data for Iceland)

Nordic Feed Evaluation System NorFor®

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Language: Danish
Parameter set: Standard
Results per page: 25

Region: Nord, Syd, Norge, Sverige, Island, Danmark, NorFor

Feed groups: 1-Korn, 2-Oliefrø, 3-Bælgplantefrø, 4-Rodfrugter, 5-Andre frø, 6-Grovfoder, 7-Andre planter, 8-Mælkeprodukter

Feed types:

Feed code:

Feed name:

Reset

Search

Report	Group-Code	Name	Region	AAT20	PBV20	NEL20	TS	Aske	Råprotein	sRåprotein	NH3-N	Råfedt
☐	001-0118	Bygg-þurrt lítil fylling	Island	102	-18	6.94	863	24	130	221	0	32
☐	001-1288	Bygg-súrsað lítil fylling	Island	101	-18	7.30	600	23	130	344	18	32
☐	001-1289	Bygg-súrsað góð fylling	Island	105	-37	7.72	600	23	115	344	18	32
☐	001-1290	Bygg-þurrt góð fylling	Island	105	-36	7.33	863	23	115	221	0	32
☐	006-0600	Ný tún snemmslegið-votverkað	Island	91	37	6.75	350	71	179	679	78	35
☐	006-0601	Ný tún meðal sláttutími-votverkað	Island	89	19	6.30	400	75	158	655	64	35
☐	006-0602	Ný tún síðslegið-votverkað	Island	72	9	5.10	400	76	125	628	59	35
☐	006-0603	Ný tún snemmslegið	Island	95	32	6.69	489	80	179	590	57	35
☐	006-0604	Ný tún meðal sláttutími	Island	93	11	6.26	560	79	158	510	42	35
☐	006-0605	Ný tún síðslegið	Island	77	2	5.06	612	82	125	442	39	35
☐	006-0606	Eldri tún snemmslegið-votverkað	Island	87	42	6.42	368	75	176	690	73	30
☐	006-0611	Eldri tún meðal sláttutími-votverkað	Island	85	32	6.19	388	75	162	658	71	30
☐	006-0612	Eldri tún síðslegið-votverkað	Island	79	14	5.61	416	75	132	625	70	30
☐	006-0613	Eldri tún snemmslegið	Island	94	30	6.40	648	75	176	550	5	30
☐	006-0614	Eldri tún meðal sláttutími	Island	94	17	6.17	662	72	162	447	5	30
☐	006-0615	Eldri tún síðslegið	Island	87	1	5.58	696	72	132	420	5	30
☐	006-0616	Rýgresi snemmslegið	Island	78	61	6.55	328	109	189	669	80	38
☐	006-0617	Rýgresi meðal sláttutími	Island	75	53	6.26	328	109	176	646	72	38
☐	006-0618	Rýgresi síðslegið	Island	67	55	5.47	328	109	162	632	65	38
☐	006-0619	2.sláttur ný tún	Island	83	35	6.28	503	86	167	592	69	34
☐	006-0620	2.sláttur eldri tún	Island	90	28	6.56	650	89	171	446	10	30
☐	006-0621	2.sláttur rýgresi	Island	86	38	6.54	402	82	176	620	70	30
☐	006-0622	Gras/hirðinga. snemmsl	Island	95	29	6.41	550	72	176	550	5	30
☐	006-0623	Gras/hirðinga. meðal sláttut.	Island	94	17	6.17	600	72	162	447	5	30
☐	006-0624	Gras/hirðinga. síðslegið	Island	87	1	5.58	650	72	132	420	5	30

1 2

IMPROVING THE GREENHOUSE GAS INVENTORY FOR THE FAROE ISLANDS

This report documents improvements made to the greenhouse gas inventory of the Faroe Islands. The improvements covered all major sectors and included whole sectors previously unaccounted for in the Faroese greenhouse gas inventory.

ISBN: 978-87-7156-728-1
ISSN: 2244-9981