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Inspire Policy Making with Territorial Evidence

ANNEX 3 – CASE STUDY REPORT //

Northern Ireland Case Study Pilot

Quantitative Greenhouse Gas Impact Assessment Method for Spatial Planning Policy

Adjusted Annex // September 2022

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Abbreviations

BER	Building Energy Rating
CLC	CORINE Land Cover
CLMS	Copernicus Land Monitoring Service
COICOP	Classification of Individual Consumption by Purpose
CORINE	Coordinated Information on the Environment
CRF	Common Reporting Format
CSC	Carbon-Stock-Change Factors
EEA	European Environment Agency
EIO	Economic Input-Output
EPC	Energy Performance Certificate
ESDAC	European Soil Data Centre
FIPS	Forest Inventory and Planning System
FUA	Functional Urban Areas
GHG	Greenhouse Gas
GWP100	Global Warming Potential over 100 years
HBS	Household Budget Survey
ICE	Internal Combustion Engine
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
LPIS	Land Parcels Information System
LULUCF	Land use, land-use change and forestry
MMR	Monitoring Mechanism Regulation
MMU	Minimum Mapping Unit
MRIO	Multi-Regional Input-Output
NEDC	New European Driving Cycle
NFI	National Forest Inventory
NIR	National Inventory Reports
NPF	National Planning Framework
p-LCA	Process-based Life Cycle Assessment
RDE	Real Driving Emissions
RSG	Reference Soil Groups
STL	Street Tree Layer
UNFCCC	United Nations Framework Convention on Climate Change
WRB	World Reference Base for Soil Resources

1 Introduction

GHG emissions were quantified for four case studies to test the GGIA tool methodology in a variety of contexts. The service providers have committed to use a range of spatial scales for the pilot case studies, this is shown through the case study selection that vary in their urban context i.e., rural, urban and suburban, whilst also differing in population sizes and geographic contexts.

Each case study consists of a baseline analysis, the quantification of selected policies and the evaluation of results. The case study pilots have been linked to relevant policy processes and the involvement of the stakeholders has been key to ensure that the link between case study and relevant spatial planning policy is present. The pilot case studies, where possible, reflect the stakeholders' envisaged use of the GGIA tool in each territory, this includes for example local authority spatial plans, development plans and national planning frameworks. The GHG analysis of the case study plans, follow key emission sectors:

- Buildings – changes in electricity and heating demands
- Infrastructure – changes in transport
- Land Use – changes in land use.

This report provides an insight into the GHG emission inventory for Rathlin Island as well as the data and methodologies applied for each sector.

2 Northern Ireland Case Study Pilot – Rathlin Island

The case study pilot for Northern Ireland is Rathlin Island. Rathlin is Northern Ireland's only offshore inhabited island, is mainly rural; its population has been steadily increasing and currently has a population of approximately 160 inhabitants. Rathlin Island lies within the Antrim Coast and Glens Area of Outstanding Natural Beauty and it has a number of natural energy resources, including wind, biofuel and geothermal; these renewable energies, however, are not being used to their full potential.

The Northern Area Plan 2016 (NAP), developed by the former Department of the Environment, is the current statutory plan for Rathlin Island. The NAP forms the basis of land use planning, decisions on planning applications and sets out to inform the general public, statutory authorities, developers and other interested parties of the policy framework and land use proposals that will be used to guide development decisions within the Plan area.

The Rathlin Island Policy (Department for Regional Development, 2010) recognises that the challenges faced on Rathlin are different to those experienced on the mainland and may have to be addressed differently. The spatial planning policy that the tool has tested out for Rathlin is the Northern Area Plan 2016.

2.1 Baseline

2.1.1 Consumption-based approach

The UK rural demand vector was applied for households in Rathlin Island. The stakeholders indicated that the average income of the area did not differ from the UK as a whole, and so no further scaling was performed based on this factor. Information was provided by the stakeholders with regards to the average household occupancy and total population of the area, respectively, and this was used to determine the per capita and total emissions for the region. Moreover, the UK electricity sector in the model was fully replaced with the Irish electricity sector (although demand was left unchanged) to account for the integration of the electricity sector across the island of Ireland. Accounting for trade, the Irish electricity grid is around 50% more carbon intensive than the UK equivalent, upstream emissions notwithstanding. Such a case area provides a significant challenge to the approach used here. The household budget surveys represent aggregated data for the whole of the UK. But the pattern of expenditure is likely to be significantly different from the UK average for residents of Rathlin Island. For example, there are no railroads on the island and so the expenditure on rail travel in the household budget survey is unlikely to be representative (purchase of rail travel whilst on the mainland notwithstanding). However, without such data as a local HBS it is difficult to know how to correctly scale or adjust consumption patterns, and here the national rural UK HBS was used.

Table 1. Description of the data situation utilised for the consumption calculations in Rathlin Island.

Data situation: Rathlin Island				
Demand Vector	Household occupancy	Household income level	Population	Further modifications / Notes
UK rural	1.74	UK average	160	Irish electricity sector used

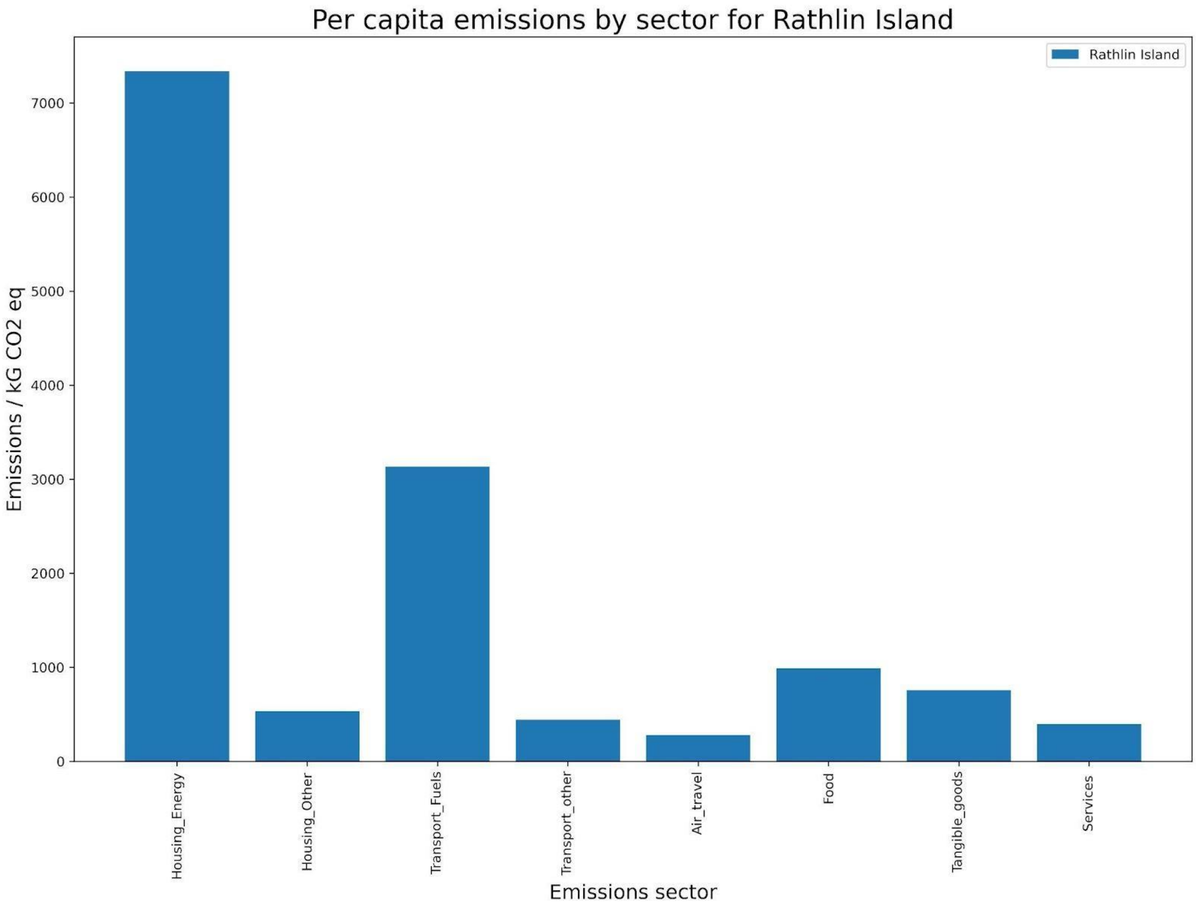

Figure 1. Per capita sectoral emissions for Rathlin Island.

Figure 1 above shows the breakdown of emissions by sector for households in Rathlin Island. Overall, the per capita emissions were 13.9 tonnes CO_2e per annum. The total consumption emissions for the region were calculated to be approximately 2.2 ktCO_2e per annum. The largest contributions to the emissions came from residential energy demand and transport fuels. Use-phase emissions significantly contribute to the residential energy demand, which reflects the large proportion of space heating arising from direct combustion of fossil fuel combustion in the household. Electricity emissions are also significant (2 tonnes CO_2e per annum) due to the high carbon intensity of the Irish grid combined with UK demand being somewhat higher than in Ireland. Transport emissions are also significant and are dominated by the use-phase. This is influenced by both the fuel mix and overall expenditure. The proportion of renewable sources in the transport fuels was only around 9% (21% for Finland).

A further feature of the emissions is the roughly equal split between the use-phase and production phases. This contrasts with both Kymenlaakso and county Meath, for which emissions are primarily from the production phases and use-phase, respectively. Food emissions are also rather significant at around 1 tonne CO_{2e} per annum. It should further be stated that the low household occupancy has a strong negative effect on emissions and is significantly below the national average for rural households (2.28 based on Eurostat figures). If the national average value was used the emissions per capita would reduce to 10.5 tonnes CO_2e per annum. However, total household emissions independent of occupation level are still higher than the other case areas. When household occupancy is considered, Edinburgh, Kymenlaakso and County Meath all have rather similar carbon footprints. Total household expenditure in 2015 was comparable across all regions in Euro terms (higher values in Ireland are somewhat mitigated by the higher household occupancy levels). The results for Rathlin Island are tabulated with greater sectoral detail in the following table. These results are also shown graphically along with those for the other case areas.

Table 2. Per capita sectoral breakdown of emissions for Rathlin Island ($kgCO_2e$/(capita,a) (2020).

Rathlin Island	Direct Production $kgCO_2e$	Indirect Production $kgCO_2e$	Use Phase $kgCO_2e$	Total $kgCO_2e$
Shelter: Electricity, heating and fuels	1,698	1,290	4,349	7,337
Shelter: Actual and imputed rent	9	40	0	50
Shelter: construction	17	42	0	59
Shelter: Waste treatment, water supply and misc.	345	84	0	429
Transport fuels	165	494	2,474	3,134
Vehicle purchases	33	243	0	276
Other transport services	145	24	0	169
Air travel	219	59	0	278
Food: Plant-based	117	57	0	174
Food: Animal-based	48	440	0	489
Food nec	35	293	0	328
Clothing	40	121	0	161
Appliances	25	167	0	192
Furniture, household commodities and misc.	119	285	0	404
Services	91	305	0	396
Sum	**3,107**	**3,946**	**6,824**	**13,877**

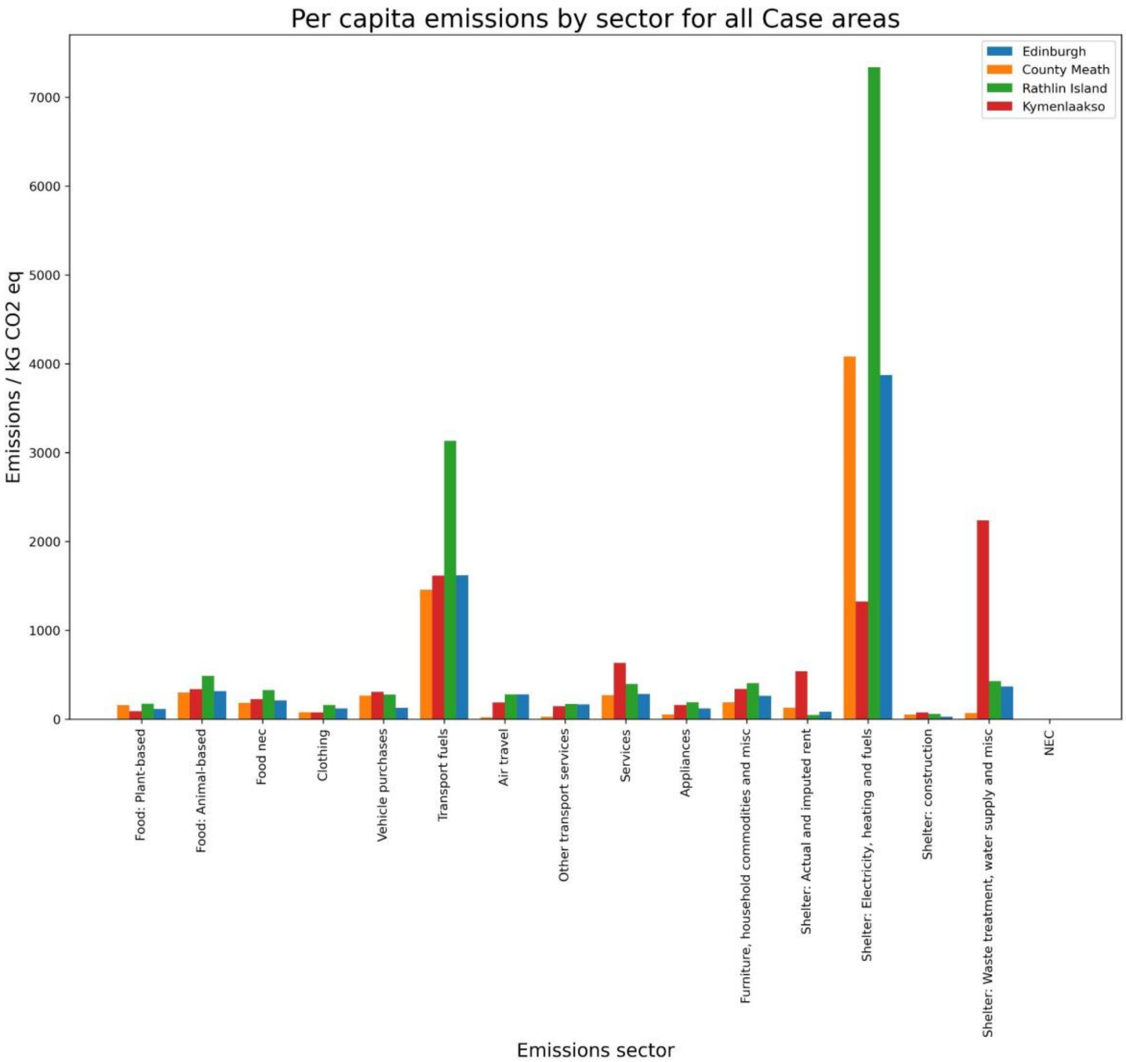

Figure 2. Per capita consumption emissions for all the case areas in 2020.

It should be noted that the EIO approach that is utilised for the consumption calculations works best at larger scales and under scenarios where the economic consumption patterns of the residents are close to average. This means that the results for Rathlin Island come with additional uncertainties compared to the other case areas. It would be interesting to compare the results here to an analysis made using another method, such as p-LCA.

2.1.2 Territorial approach

2.1.2.1 Buildings

This section looks at the emissions arising from the building sector in Rathlin Island, it includes both residential and commercial buildings and also analysis results from the baseline, which gives insight into the current building stock for Rathlin Island. This baseline information is then used to compare with emissions resulting from spatial planning policy changes.

Energy data at a local level is currently not available for Northern Ireland. Rathlin Island is a very specific case study; therefore, localised data is especially relevant. This methodology is based on information gathered by the community association on the island, Rathlin Development and Community Association (RDCA), and on an energy audit that was carried out as part of a Master's thesis. The thesis report by McElrone (McElrone, 2019) is based on local level information that was gathered from monitored data provided by energy suppliers and questionnaire responses that were submitted by Rathlin Island's residents.

The questionnaires produced were targeted towards residential/domestic energy use and another questionnaire for commercial energy use on the island, thus covering both domestic and non-domestic buildings. The energy questionnaires were developed in line with the Sustainable Energy Authority of Ireland's (SEAI) Energy Audit Handbook for 2016 and covered a range of energy efficiency questions.

Residential sector

The data for the housing sector was broken down into type of housing, and period built. This breakdown allows for a higher level of accuracy when applying average energy use to all housing

Residential units were broken down into:

- Detached
- Semi-detached
- Terraced
- Apartments.

There were approximately 100 dwellings on Rathlin Island, with 14% of the housing stock considered holiday homes. In 2018, the largest share of residential units were semi-detached houses; they made up 42% of the total residential housing stock in Rathlin. This was followed by detached houses (38%) and terraced (16%), whilst the lowest share of housing were apartments, comprising 4% of Rathlin Island's housing stock.

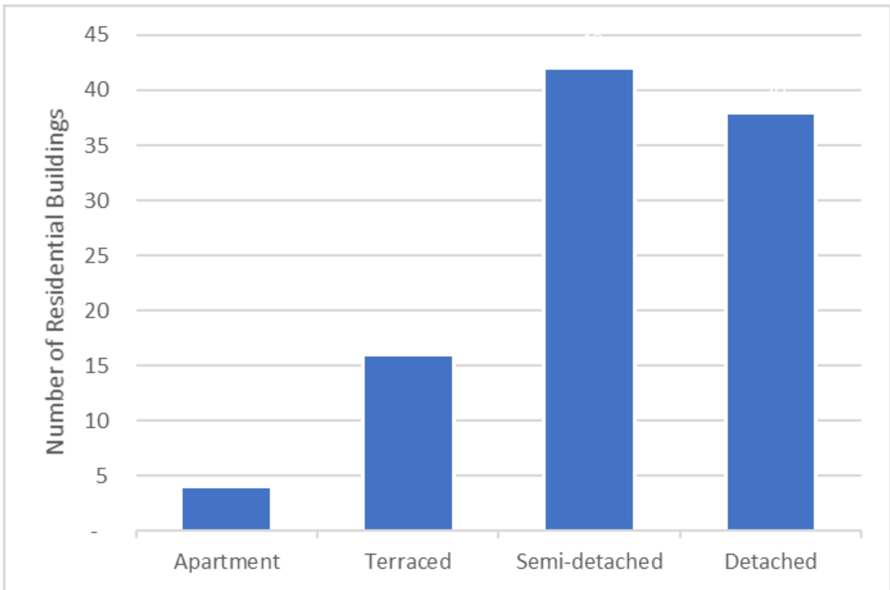

Figure 3. Total number of residential units in Rathlin.

From data provided, energy use in the residential sector was found to total 2.40 GWh. The residential fuel split mainly comes from heating oil, which makes up 75% of the total energy use in this region. Oil boilers were found to be the most common main source of heating on the island, followed by stoves and solid fuel boilers. Electricity had the second highest energy demand, making up 13% of the fuel mix. In 2018 Rathlin Island had a total of 128 electrical connection points in 2018, of which 101 connections were domestic connection points and accounted for 320 MWh.

Figure 4 shows the total final energy use broken down into the different energy demand areas. Most of the energy used was for space heating. Space heating had by far the highest energy demand, accounting for 61% of the total. This is followed by water heating at 26%. Heating overall in the residential sector has the highest energy demand by far and creates potential for heat recovery from waste heat and district heating as a way of catering for this high heat demand. Lighting and appliances are the least energy intensive, making up 13% of the total demand, it should be noted that lights & appliances also include energy demand for fans and pumps.

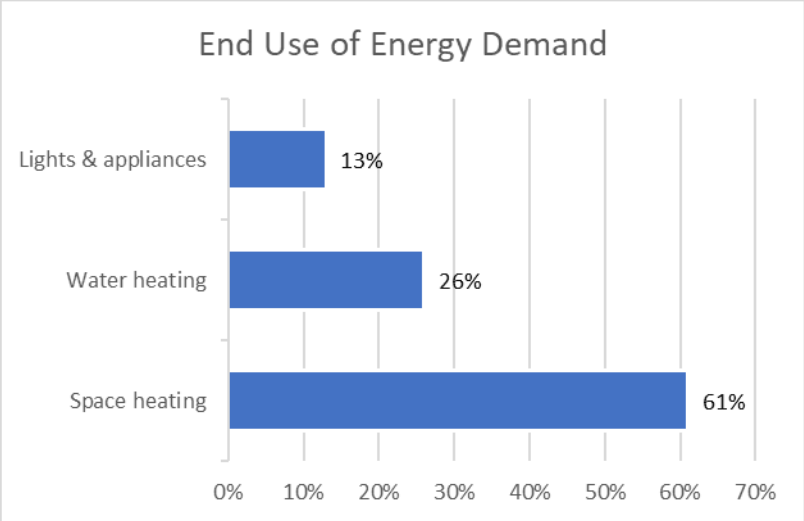

Figure 4. Share of residential energy demand in Rathlin.

Total emissions from the residential sector in Rathlin amounted to 726 tonnes of CO_2 in 2018. Figure 5 depicts the total emissions grouped by fuel and dwelling type. Semi-detached houses had the highest emissions, accounting for 305 tonnes of CO_2. This was followed by detached houses, terraced houses and apartments, all of which accounted for 276, 116 and 29 tonnes of CO_2 respectively, of the total emissions in the residential sector.

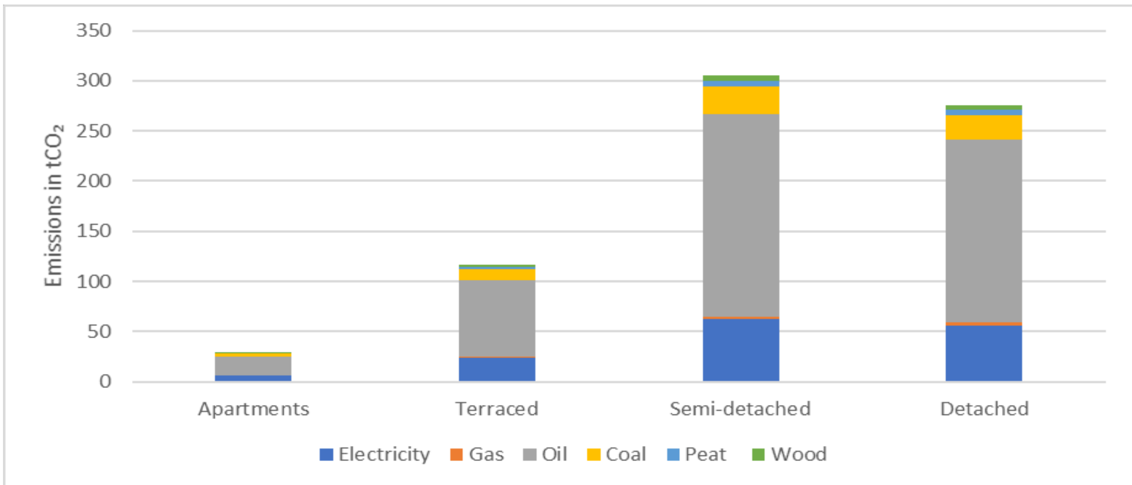

Figure 5. Total Emissions in tCO_2 in the residential sector by fuel mix and dwelling type.

The highest emissions in the residential sector come from heating oil, electricity and coal, which contribute 66%, 20% and 9% respectively. There was very little peat, biomass (mainly wood) and bottled gas used in the residential sector, only contributing to 5% of total emissions.

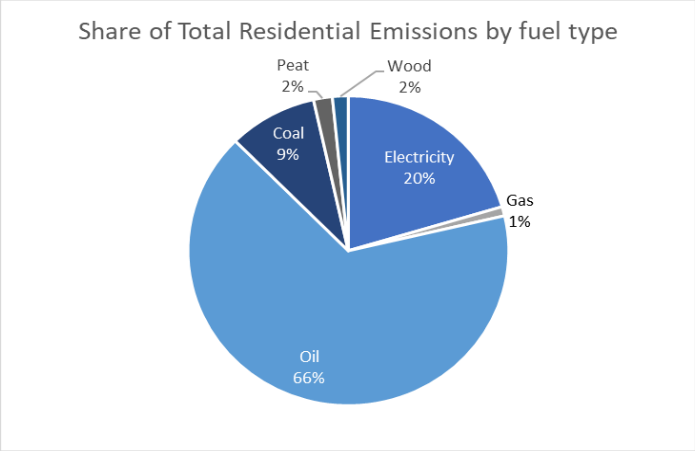

Figure 6. Share of total emissions in the residential sector by fuel type.

Table 3. Total residential emissions in Rathlin.

Residential sector	Fuel						Total
	Electricity	Gas	Oil	Coal	Peat	Wood	
Apartments	5.93	0.28	19.21	2.60	0.55	0.46	29.03
Terraced	23.70	1.11	76.85	10.41	2.20	1.85	116.13
Semi-detached	62.23	2.92	201.73	27.32	5.78	4.85	304.83
Detached	56.30	2.64	182.52	24.72	5.23	4.39	275.80
Total tCO_2	**148.16**	**6.95**	**480.30**	**65.05**	**13.77**	**11.55**	**725.79**

Commercial

Data on the number and type of commercial buildings could not be located. However, from data provided, it was found that Rathlin Island had a total of 128 electrical connection points in 2018, 27 of which were commercial connection points, thus, it was assumed that commercial buildings totalled 27. Local level information on the types of buildings present on the island was used to create a dataset of typical commercial floor areas for different property categories. This, however, might not be an accurate representation of the share of commercial property categories found on Rathlin Island, therefore, once more accurate information is located then it can be used to update the dataset created.

The different commercial property categories outlined in this section are:

- Health
- Hospitality
- Industrial Uses
- Office
- Retail
- Warehouse.

The total energy used in the commercial sector was 1.4 GWh. Bottled gas (660 MWh), heating oil (371MWh) and electricity (364 MWh) accounted for this energy use.

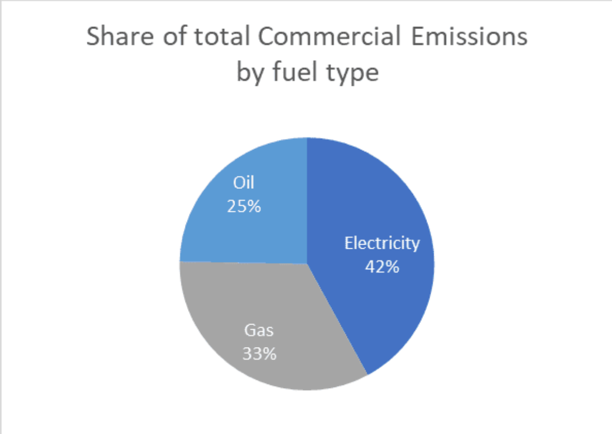

Figure 7. Share of total emissions in the commercial sector by fuel type.

Total emissions from the commercial sector in 2018 amounted to 401 tonnes of CO_2. Of the total emissions emitted by the commercial sector, electricity accounts for the largest share of the total emissions (42%), followed by bottled gas at 33% and heating oil (25%).

Table 4. Total commercial emissions in Rathlin.

	Fuel						
Commercial sector	Electricity	Gas	Oil	Coal	Peat	Wood	**Total**
Retail	23.20	2.07	1.54	0	0	0	26.81
Health	30.16	54.30	40.37	0	0	0	124.83
Hospitality	90.48	67.87	50.46	0	0	0	208.82
Offices	15.78	8.53	6.34	0	0	0	30.65
Industrial	0	0	0	0	0	0	0
Warehouses	9.28	0.57	0.42	0	0	0	10.27
Total tCO_2	**168.90**	**133.34**	**99.14**	**0**	**0**	**0**	**401.37**

Total emissions

Total emissions from both the residential and commercial sectors in Rathlin accounted for 1,127 tonnes of CO_2 in 2016. The residential sector contributed 64% and the commercial sector 36% to the total emissions. The main source of emissions come from heating oil (51%), followed by electricity (28%) and bottled gas (13%). The rest of emissions (approximately 7%) were made up of coal, biomass (wood) and peat.

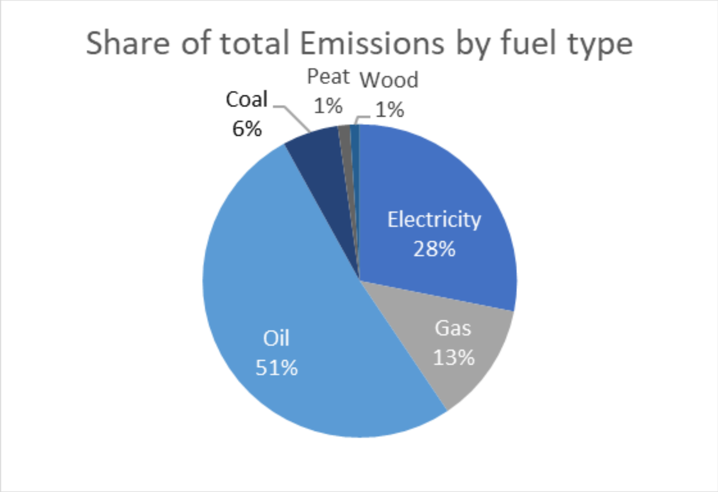

Figure 8. Share of total emissions in the building sector by fuel type.

Table 5. Total emissions from the building sector in Rathlin Island.

Building sector	Electricity	Gas	Oil	Coal	Peat	Wood	Total
Residential	148.16	6.95	480.30	65.05	13.77	11.55	725.79
Commercial	168.90	133.34	99.14	-	-	-	401.37
Total tCO_2	**317.05**	**140.29**	**579.44**	**65.05**	**13.77**	**11.55**	**1,127.16**

2.1.2.2 Transport

The transport activity data for Rathlin Island is based on a recent study on sustainable transport strategy (McLaughlin, 2019), which included a transport survey for the residents. The thesis project applies a consumption-based approach in the GHG quantification of transport including all transport by the residents of Rathlin Island. However, the territorial assessment includes only the transportation on the Rathlin Island. The island has a ferry connection to the mainland and has no transit transport at all. Therefore, the estimate on the annual number of vehicle-kilometres for this calculation is smaller than in previous studies.

Cars and vans

Rathlin Island had about 70 cars, 11 vans and 16 4x4s in 2019.

According to the transport survey, 50% of the vehicles are in daily use. 31% of the vehicles are use in most day, and 19% only once or twice a week. Based on this information, the average number of car trips was estimated 378/week on the island. This equals to 19,656 trips per year. For vans and 4x4s, an assumption of one trip per day was applied. As most of the settlement is located quite close to the ferry port, an average length of one trip (on Rathlin) was assumed 5 kilometres only.

80% of vans and cars have diesel engines and 20% petrol engines. 4x4s were assumed diesel-fuelled.

Minibuses

The island fleet includes tourist minibuses. The tourist buses were assumed to drive 140 trips per year, with the average trip length of 14 kilometres (the distance from the ferry port to the Rathlin West Light Seabird Centre and back). These were assumed diesel buses, with a conversion factor of 300 gCO_2e/km.

Table 6. Transport activity and annual road transport emissions on Rathlin Island.

Vehicle type	Fuel type	Number of vehicles	Vehicle-km/a	Emission factor gCO_2e/km	Total emissions tCO_2e/a
Passenger car	diesel	56	78624	168	13.2
	petrol	14	19656	174	3.4
4x4	diesel	16	29200	191	5.6
Van	diesel	9	16425	241	4.0
	petrol	2	3650	210	0.8
Minibus	diesel	4	1960	300	0.6
Total					**27.6**

In other pilot case studies of this project, off-road vehicles, ferries and boats were excluded from the transport emissions calculation.

2.1.2.3 Land use

The distribution of Rathlin Island land cover classes and soil types are shown in Figure 9 and Figure 10.

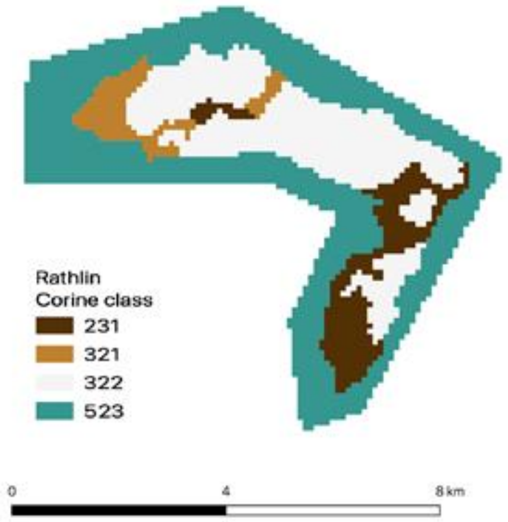

Figure 9. CORINE land cover classes in Rathlin Island.

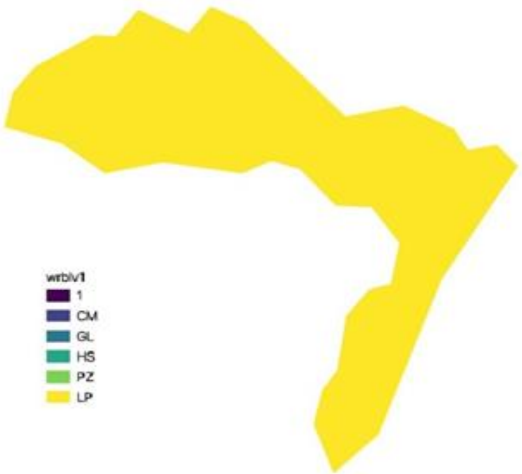

Figure 10. Soil types in Rathlin Island (European Soil Database).[1]

There are four level 3 CORINE land cover classes that can be categorised into grasslands and unmanaged land according to IPCC land-use categories in Rathlin Island. The dominant land cover is semi-natural areas (CORINE class 3 ≈ IPCC category grasslands, natural grasslands as unmanaged land) that constitute 69% of total Rathlin area (*Table 7*). Agricultural areas (CORINE class 2 ≈ IPCC grasslands) cover 20% of total area, followed by water bodies (CORINE class 5 ≈ IPCC unmanaged land). According to the European Soil Database there are only Leptsosol soils that are classified as IPCC mineral soils.

[1] WRB soil classes: 1- no soil/no information available; CM - Cambisol; GL - Gleysol; HS - Histosol; PZ - Podzol; LP – Leptosol.

Table 7. Rathlin Island land use and soil types.

CORINE land class		IPCC land-use category	IPCC soil type (ha)		Total area (ha)
			mineral	organic	
Class 2: Agricultural areas	231	Grassland	287	0	287
Class 3: Forest and semi-natural areas	321	Unmanaged land	147	0	147
	322	Grassland	839	0	839
Class 5: Water bodies	523	Unmanaged land	154	0	154
Total			**1,428**	**0**	**1,428**

The UK compiles and reports three different sets of CRF tables, each with a different geographical coverage of emissions to fulfil the reporting requirements of the EU Monitoring Mechanism Regulation (MMR), the Kyoto Protocol, and the UNFCCC (UK Department for Business, Energy & Industrial Strategy, 2021). In the current analysis, the implied carbon-stock-change factors from the Convention (UNFCCC) CRF tables were applied which corresponds directly to the framework of the IPCC LULUCF methodology. Although the UK has data sources available at the individual country level (England, Scotland, Wales and Northern Ireland), combined results are published in the greenhouse gas reports to give UK totals (UK Greenhouse Gas Inventory 1990 to 2019); (United Kingdom. 2021), meaning carbon-stock-change factors are not provided separately for individual country level. Therefore, the combined CSC factors of the UK[2] (Table 8) were implemented in the Northern Ireland baseline analysis. Estimated annual emissions are shown in Table 9.

[2] UK reports carbon-stock-change factors separately for 'United Kingdom' (incl Northern Ireland) and 'Overseas Territories and Crown Dependencies' in its CRF tables. The values of the CSC factors for the United Kingdom were applied in the current analysis.

Table 8. UK's land use carbon-stock-change factors (Submission 2021, inventory year 2019).

Carbon-stock-change factors	Biomass		Dead organic matter		Soil	
tC/(ha, a)	above-ground	below-ground	dead wood	litter	mineral	organic
Forest land remaining forest land	0.75	IE[3]	0.31	0.04	0.40	-2.00
Cropland remaining cropland	-0.0003	IE	NO	NO	-0.33	-8.19
Grassland remaining grassland	-0.003	IE	NA	NA	0.39	-1.09
Peat extraction remaining peat extraction	NO	NO	NO	NO	NO	-2.24
Settlements remaining settlements	2.51	IE	NA	NA	-0.43	-0.18

NO – not occurring/no emissions.

IE – included elsewhere.

NA – not applicable/reporting not required.

Negative CSC factors denote decrease and positive increase in the C pool.

Table 9. Baseline land use emission estimates in Rathlin Island (tCO_2/a).

	Biomass		Dead organic matter		Soil		
IPCC Land use category	above-ground	below-ground	dead wood	litter	mineral	organic	**Total**
Grassland	12	IE	0	0	-1,624	0	-1,612
Total	**12**	**IE**	**0**	**0**	**-1,624**	**0**	**-1,612**

Emissions have positive and removals negative signs.

IE – included elsewhere.

The land use sector in Rathlin Island is estimated to be currently a net sink of -1,612 tCO_2. Annual CO_2 removals are related to carbon sequestration in managed grassland mineral soils, while grassland biomass is estimated to decrease slightly causing minor emissions. Rathlin has a large share of designated conservation and protected areas, some of which probably fall under the CORINE class 322 Moors and heathland. The latter are considered as managed grasslands according to the UK's NIR, however might be unmanaged in Rathlin. IPCC methodology does not take into account emissions/removals from natural and unmanaged areas; thus, the total carbon sink might be overestimated in Rathlin case study.

[3] Included under aboveground biomass.

2.2 Spatial planning policies

The aim of the Northern Area Plan (NAP) (Department of the Environment (NI) 2016) is to provide a framework for development throughout the area, conforming with the strategy and guidance set out in the Regional Development Strategy 2035 (RDS) - (Department for Regional Development 2012), facilitating sustainable growth, meeting the needs of communities and protecting environmental attributes.

Policies from the NAP that the tool will quantify for the building sector relate to the promotion and facilitation of energy efficient building design, as well as the use of lower carbon fuels in buildings. While no numerical proposals are highlighted, nevertheless, the following policies from the NAP can be quantified:

- Regional Planning Context - Promoting more sustainable development within existing urban areas and ensuring an adequate and available supply of quality housing to meet the needs of everyone.

The tool developed will quantify the impact on emissions from:

1) Construction of new buildings, both residential and commercial buildings
2) Retrofits of the building sector – which will also allow for changes in the current buildings' space and water heating to account for changes in technologies such as changing from boilers to heat pumps or alternatively to account for connections to low carbon heat
3) Changes in urban densification
4) Change in building use (from commercial to residential or vice versa)
5) Increase in renewable energy generation from retrofits and new buildings.

Policies of NAP are examined in the light of the sustainable transport strategy study provided by McLaughlin (McLaughlin, 2019). Rathlin Island has a large share of areas of international and national conservation importance (Ballycarry, Ballygill North, Rathlin Island Coast, Kebble, Kinramer South). The importance of conserving the landscape and natural resources of the rural areas and protecting it from excessive, inappropriate or obtrusive development is recognised. NAP does not propose any direct land use changes in Rathlin Island. According to CORINE maps grassland is the dominant managed land category in Rathlin. The most realistic land use changes are grassland conversion to cropland and grassland conversion to settlements that can be quantified.

2.2.1 Policies to be quantified

2.2.1.1 Buildings

Retrofitting

As mentioned previously, there are no indicative numerical proposals in the NAP, however when addressing actions such as retrofit in buildings the Consultation on Policy Options for the Energy Strategy for Northern Ireland developed by the Department for the Economy[4] suggests that a '*peak of 50,000 homes might need to be retrofitted annually'*. This would mean that in Rathlin Island, a total of six homes per year have to be retrofitted to a C or B EPC rating (as suggested in the Energy Strategy).

<u>Territorial emissions</u>

By proportioning the retrofits depending on the number of dwellings for each building type (apartments, terraced, etc.), of these six homes that need to be retrofitted each year; one terraced, three semi-detached and two detached houses need to be retrofitted (apartments have been included, however as there are only 4 apartments in Rathlin and they are proportionally too small to account for considering that only 6 retrofits are to be completed per year). Retrofitting these households from an assumed E to a C EPC rating would result in a reduction of 48 tonnes of CO_2 in the building sector

[4] https://www.economy-ni.gov.uk/sites/default/files/consultations/economy/energy-strategy-for-NI-consultation-on-policy-options.pdf

Consumption-based emissions

The same assumption was made regarding the number of houses to be retrofitted as in the territorial side of the calculations. The houses were originally assumed to be at energy class E and were upgraded to energy class C. It is assumed that this leads to household energy savings of around 54%. The calculation was performed for the year 2026. This results in per capita emissions of 12.2 tCO_2e across the whole population (the emissions of the residents of the retrofit homes would be necessarily less). The baseline equivalent would be 12.3 tCO_2e and the total emissions savings would be 29 tCO_2e. If the retrofit was to energy class B (68% savings), then the savings would be 36 tCO_2e and per capita emissions would be 12.1 tCO_2e.

Renewable energy generation

Territorial emissions

Retrofitting these households from an assumed E to a C EPC rating could potentially increase renewable energy generation by 1.68 MWh per annum if 10% of the electricity generated in the buildings retrofitted comes from renewable energy sources such as photovoltaics. No information on commercial retrofit could be found for Northern Ireland or Rathlin Island. It should also be noted that the tool can quantify construction of new residential and commercial developments, however for this case study, which faces different challenges to other case study areas, it was deemed that construction of new buildings would be highly unlikely to occur during the course of the NAP.

Consumption-based emissions

The same assumptions were used for the consumption-based quantification. The policy was quantified in 2026. If a total of 6 houses gain 10% of their energy from renewable energy following the retrofits, then this corresponds to an approximate 0.6% of the total electricity use in the area. The consequent emissions per capita would be 12.2 tCO_2e in 2026 (when taken to 3 significant figures), leading to an emissions saving of 31 tCO_2e (of which the renewable energy contributes 1.8 tCO_2e).

2.2.1.2 Transport

These policies were all considered in a similar fashion. Due to the lack of quantitative information provided, these results should then not be taken as indicative of the expected changes in emissions following these policies, but rather illustrative of how the tool can quantify transport related policies should such data be available. The calculation was performed in 2026 in all cases.

Improving the provision of public transport

Consumption-based emissions

This policy was implemented through a 20% reduction in private fuel purchases, a 10% reduction in purchases towards car ownership and maintenance, and a 20% increase in expenditure by households on public transport. The policy was quantified for the year 2026. The per capita emissions across the whole of Rathlin Island were 11.8 tCO_2e following this policy. This led to a saving of 88 tCO_2e in total when considered against the baseline emissions.

Enhancing cycling and walking facilities

Consumption-based emissions

This policy was implemented with the same reductions in private transport as the previous policy, but without any increase in the expenditure on public transport. This led to per capita emissions in 2026 of 11.7 tCO_2e, and total emissions savings of 93 tCO_2e.

Provision of park-and-ride facilities

Consumption-based emissions

This policy was implemented through a 20% reduction in private transport fuel purchases, a 20% increase in public transport purchases, but without any changes in the purchases for car ownership and maintenance. This led to a per capita emissions of 11.8 tCO_2e and a total reduction across the island of 84 tCO_2e in 2026.

Increasing remote working

Consumption-based emissions

This was implemented by a 20% reduction in private transport fuels, but no changes to public transport expenditure or expenditure on private vehicle ownership by households. This led to per capita emissions of 11.8 tCO_2e in 2026 and total savings of 89 tCO_2e. However, increased telecommuting could also lead to an increase in energy use by households. This could also be modelled via a 5% increase in the expenditure on household heating. In this case the per capita emissions would be 12.1 tCO_2e and the savings would be reduced to 37 tCO_2e. However, it is important to stress that energy use in commercial or municipal buildings, which may decrease with more telecommuting, can't be tracked using a household carbon footprint approach. Therefore, part of the carbon footprint is being reassigned from people's place of work to the household. Assuming these energy savings would be equivalent to the increase in private households leads to these factors cancelling out.

2.2.2 Quantification results

The results of the policy quantification are summarised in the following table. In general, there was a lack of quantitative numbers linked to specific policies in the reference document, meaning assumptions were required to perform the calculations.

Table 10. Quantifying spatial planning policies for Rathlin Island.

policy	impact	module	quantification in GGIA	CO_2e increase / decrease (tCO_2)	Emissions per capita (tCO_2/capita)
1. Retrofitting	2016-26	energy use in buildings	change in energy consumption profile of existing buildings	48.02	
		consumption-based	change in expenditure on energy	29 (E to C) 36 (E to B)	12.2 12.1 (in 2026)
2. Increase in renewable energy generation	2016-26	energy use in buildings	change in energy consumption profile of existing buildings	15,338	
		consumption-based	increase in the share of renewable energy	31	12.2 (in 2026)
3.1 Improving the provision of public transport	2016-26	transport	reduction in passenger car transport; increase in bus transport		
		consumption-based	part of the transport expenditure moves from passenger cars to public transport	88	11.8 (in 2026)
3.2 Enhancing cycling and walking facilities	2016-26	transport	reduce transport activity		
		consumption-based	decrease transport expenditure	93	11.7 (in 2026)
3.3 Provision of park-and-ride facilities	2016-26	transport	adjusting modal shares		
		consumption-based	part of the transport expenditure moves from passenger cars to public transport	84	11.8 (in 2026)
3.4 Increasing remote working	2016-26	transport	reduce transport activity		
		consumption-based	Decrease transport expenditure	89.2 37 (with 5% increased household energy use)	11.8 (in 2026) 12.1 (with 5% increased household energy use)

3 Conclusions

This section identifies the key findings from the different carbon emitting sectors for both the consumption and territorial-based approaches, and also discusses the actions from the quantified spatial planning policies that can contribute the most to emission reductions in Rathlin Island.

3.1 Key findings from the baseline

It should be noted that both approaches for estimating emissions, have identified the transport and building sectors as having the highest emissions and consumed more fossil fuels than the other sectors. Thus from this analysis, these sectors should be the main targets of energy and emission reduction initiatives.

3.1.1 Consumption-based approach

- The per capita emissions were 13.9 tonnes CO_2e/a.
- The total consumption emissions for the region were calculated to be approximately 2.2 ktCO_2e/a.
- The largest contributions to the emissions came from residential energy demand and transport fuels. Use-phase emissions significantly contribute to the residential energy demand, which reflects the large proportion of space heating arising from direct combustion of fossil fuel combustion in the household.
- Electricity emissions are also significant (2 tCO_2e/a) due to the high carbon intensity of the Irish grid, combined with UK demand being somewhat higher than in Ireland.
- Transport emissions are also significant and are dominated by the use-phase. This is influenced by both the fuel mix and overall expenditure. The proportion of renewable sources in the transport fuels was only around 9 %.

3.1.2 Territorial approach

3.1.2.1 Buildings

- Total emissions from both the residential and commercial sectors in Rathlin accounted for 1,127 tonnes of CO_2 in 2016.
- The residential sector contributed 64% and the commercial sector 36% to the total emissions.
- The main source of emissions come from heating oil (51%), followed by electricity (28%) and bottled gas (13%).

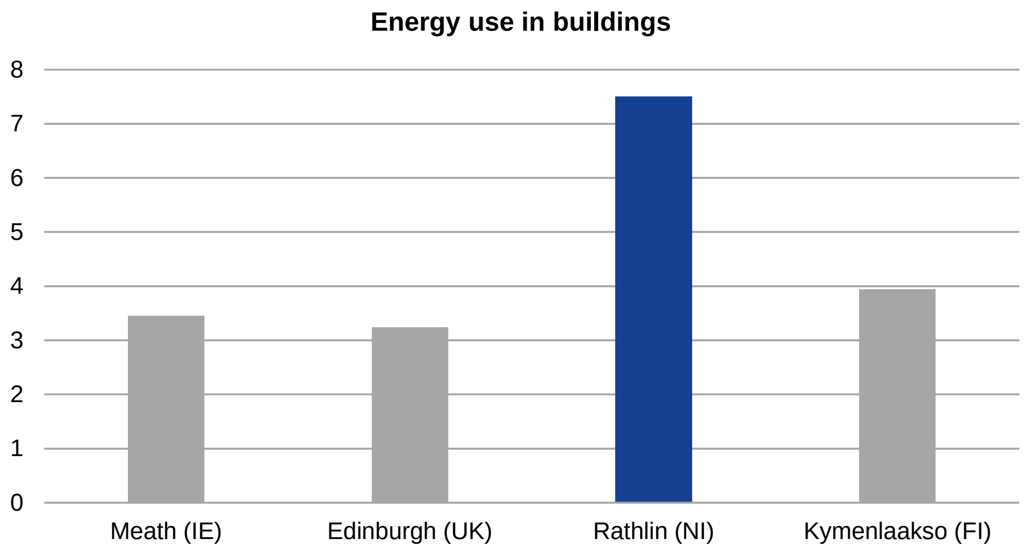

Figure 11. Annual buildings baseline emissions per capita ($tCO_2e/(capita,a)$).

3.1.2.2 Transport

- Transport on Rathlin Island is mainly made up of passenger vehicles (97 vehicles) and diesel buses (four 30-seater buses).
- The majority of emissions from passenger vehicles come from diesel cars, which make up 80% of the total vehicles, followed by petrol cars, only accounting for 20% of the vehicles.

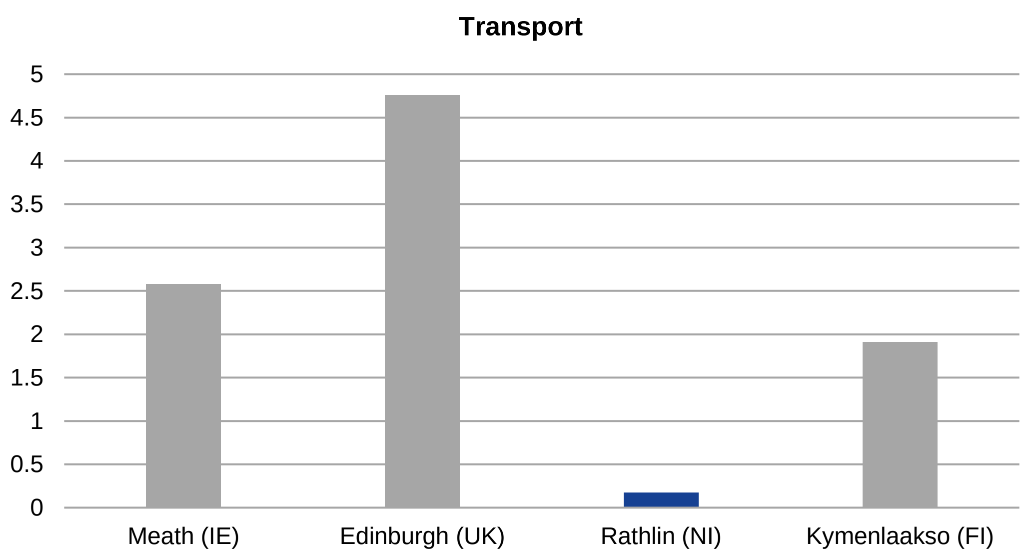

Figure 12. Annual transport baseline emissions per capita ($tCO_2e/(capita,a)$).

3.1.2.3 Land use

- The land use sector in Rathlin Island is estimated to be currently a net sink of -1,612 tCO_2
- Annual CO_2 removals are related to carbon sequestration in managed grassland mineral soils, while grassland biomass is estimated to decrease slightly causing minor emissions.
- Rathlin has a large share of designated conservation and protected areas, some of which probably fall under the CORINE class 322 Moors and heathland.

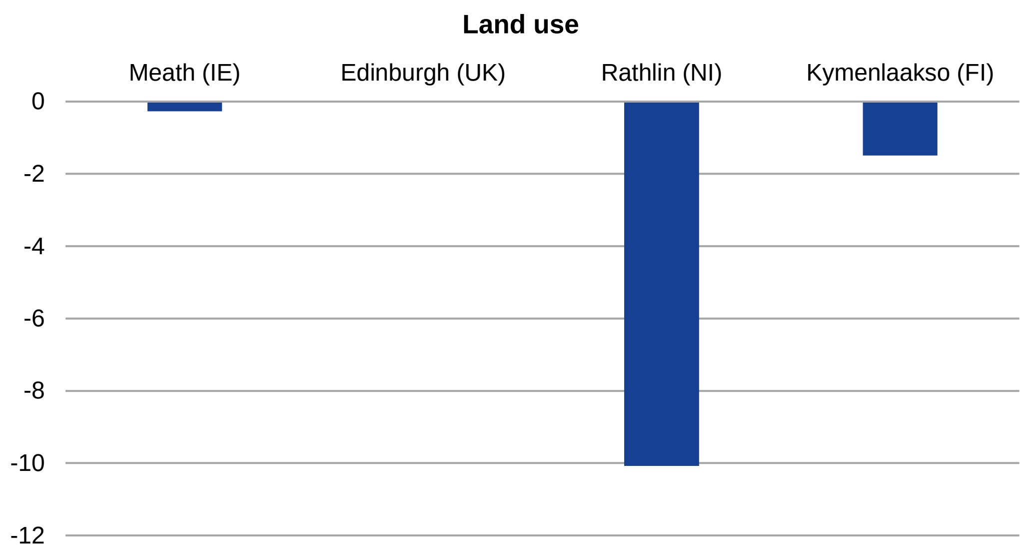

Figure 13. Annual Land use baseline emissions per capita (tCO_2e/(capita,a)).

3.2 Key Findings from the action quantification of spatial planning policies

From the actions that were quantified for the Northern Area Plan (NAP), retrofitting and transport related actions had the greatest potential to reduce emissions.

Retrofitting the households identified in this study from an assumed E to a C EPC rating would result in a reduction of 48.02 tonnes of CO_2 in the building sector.

Meanwhile, increasing telecommuting by implementing a 20% reduction in private transport fuels, but no changes to public transport expenditure or expenditure on private vehicle ownership by households, led to per capita emissions of 11.6 tCO_2e in 2026 and total savings of 88 tCO_2e.

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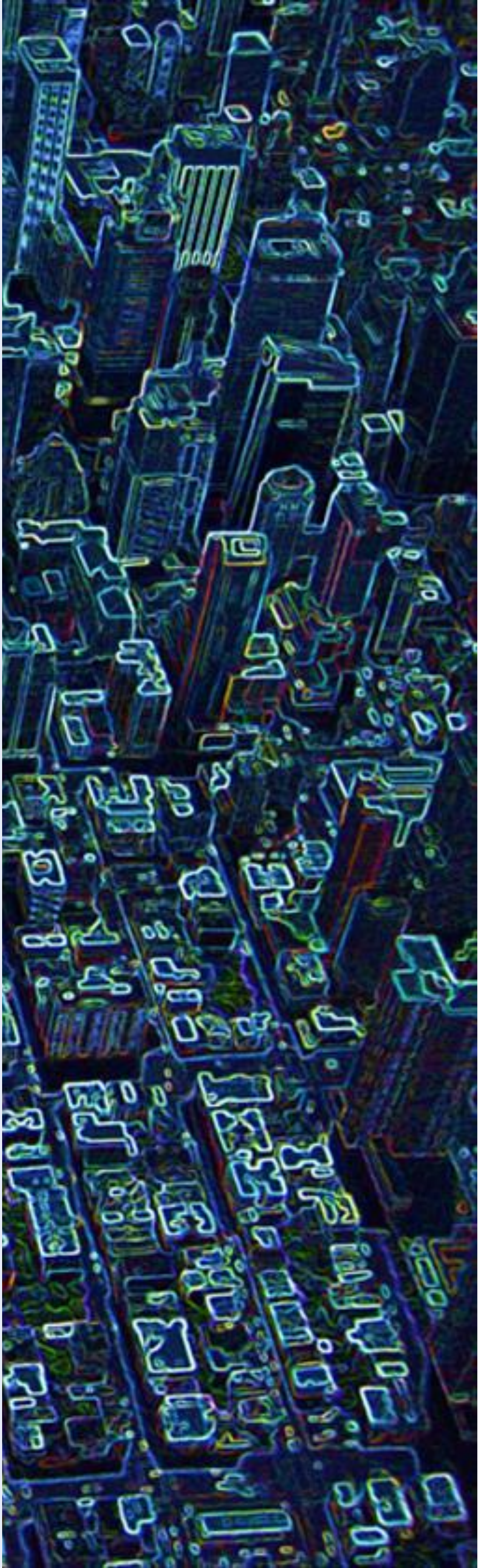

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