The Government of
ST. KITTS and NEVIS

First Biennial Update Report (BUR1)

of the

Government of St. Kitts and Nevis

To the United Nations Framework Convention on Climate Change (UNFCCC)

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St. Kitts and Nevis
First Biennial Update Report

In fulfilment of its commitment under the United Nations Framework Convention on Climate Change

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First Biennial Update Report to the United Nations Framework Convention on Climate Change

We would like to recognise the partners who have contributed to the project outlined in this publication, the United Nations Environmental Programme (UNEP) and the Global Environment Facility (GEF), for their support and financial contribution.

Foreword

Like other Small Island Developing States (SIDS), St. Kitts and Nevis considers climate change to be a significant threat to its growth and prosperity. For this reason, the Government of St. Kitts and Nevis remains committed to its national reporting requirements to the United Nations Framework Convention on Climate Change (UNFCCC). This was evidenced in our updated Nationally Determined Contribution (NDC) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) and by our ratification of the Paris Agreement on April 22, 2016, along with many other Parties to the Convention.

St. Kitts and Nevis hereby presents its First Biennial Update Report (BUR1) to the United Nations Framework Convention on Climate Change. The BUR1 contains information relating to our national Greenhouse Gas (GHG) inventories as well as a national inventory report and information on mitigation actions, needs and support. The report will also provide an update on actions undertaken by the Government to implement the Convention, including the status of our GHG emissions and removals by sinks.

Although when compared to global GHG emissions, our contributions are negligible, St. Kitts and Nevis is committed to doing its part. Climate change is a challenge that will likely affect both the natural environment as well as the social and economic stability of the country. As such, St. Kitts and Nevis is endeavouring to become a low carbon economy, which will also provide ancillary benefits for sustainable energy usage and developments, as well as reducing the cost of adaptation. Mitigation strategies will also result in regional and global benefits, whose evidence will be witnessed in future decades.

In 2022, the Government has committed to sustainable measures for effective emissions reduction, energy conservation and renewable energy supply. a clear agenda has been adopted to transform St. Kitts and Nevis into a sustainable island state, founded on seven (7) key pillars, namely, food 4 security, green energy transition, economic diversification, sustainable industries, the Creative Economy, COVID-19 recovery, and social protection. Improving dataset accuracy and availability will be critical to support the Government's agenda.

The preparation of St. Kitts and Nevis First Biennial Update Report was made possible through the financial support of the Global Environmental Facility (GEF) through the United Nations Environment Programme (UNEP). The report compilation was the result of the combined input and participation of a wide range of stakeholders across the various sectors of the economy, including government agencies, statutory bodies, non-governmental organizations and civil society and was led by the Ministry of Environment. The Government of St. Kitts and Nevis wishes to use this opportunity to express appreciation to all stakeholders involved in the process and wishes to re-iterate that a whole of society approach, working together nationally, regionally and internationally will be paramount to improve resilience, sustainability as well as achieving the goal of the Paris Agreement.

Hon Dr Joyelle Clarke
Minister of Sustainable Development, Environment, Climate Action and Constituency Empowerment

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Acronyms and Abbreviations

5AR	IPCC 5th Assessment Report
AD	Activity Data
ADP	Durban Platform for Enhanced Action
AFOLU	Agriculture, Forestry and Other Land Use
BAU	Business-as-usual
BUR	Biennial Update Report
BUR1	1st or initial Biennial Update Report
BY	Base Year 2014
COP	Conference of the Parties
CREEBC	CARICOM Regional Energy Efficiency Building Code
CRF	Common Reporting Format
EF	Emission Factor
FY	First Year of the data series (2008)
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GWP	Global Warming Potential
HPS	High Pressure Sodium
IE	Included Elsewhere
INC	Initial National Communications

IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IRP	Integrated Resource Plan
IWECO	Integrated Water, Land and Ecosystem Project
LEAP	Low Emissions Analysis Platform
LULUCF	Land Use, Land Use Change and Forestry
MRV	Monitoring, Reporting and Verification
NA	Not Applicable
NC	National Communications
NCV	Net Caloric Value
NDC	Nationally Determined Contributions
NE	Not Estimated
NEVLEC	Nevis Electricity Company
NIR	National GHG Emission Inventory Report
NO	Not Occurring
OLADE	Organización Latinoamericana de Energía
PPA	Power Purchase Agreement
PY	Previous Year
QA	Quality Assurance
QC	Quality Control
RAC	Refrigeration and Air Conditioning Sector
SIDS	Small Island Developing States
SKELEC	St. Kitts Electricity Company

SKN	St. Kitts and Nevis
SNC	Second National Communications
UNFCCC	United Nations Framework Convention on Climate Change

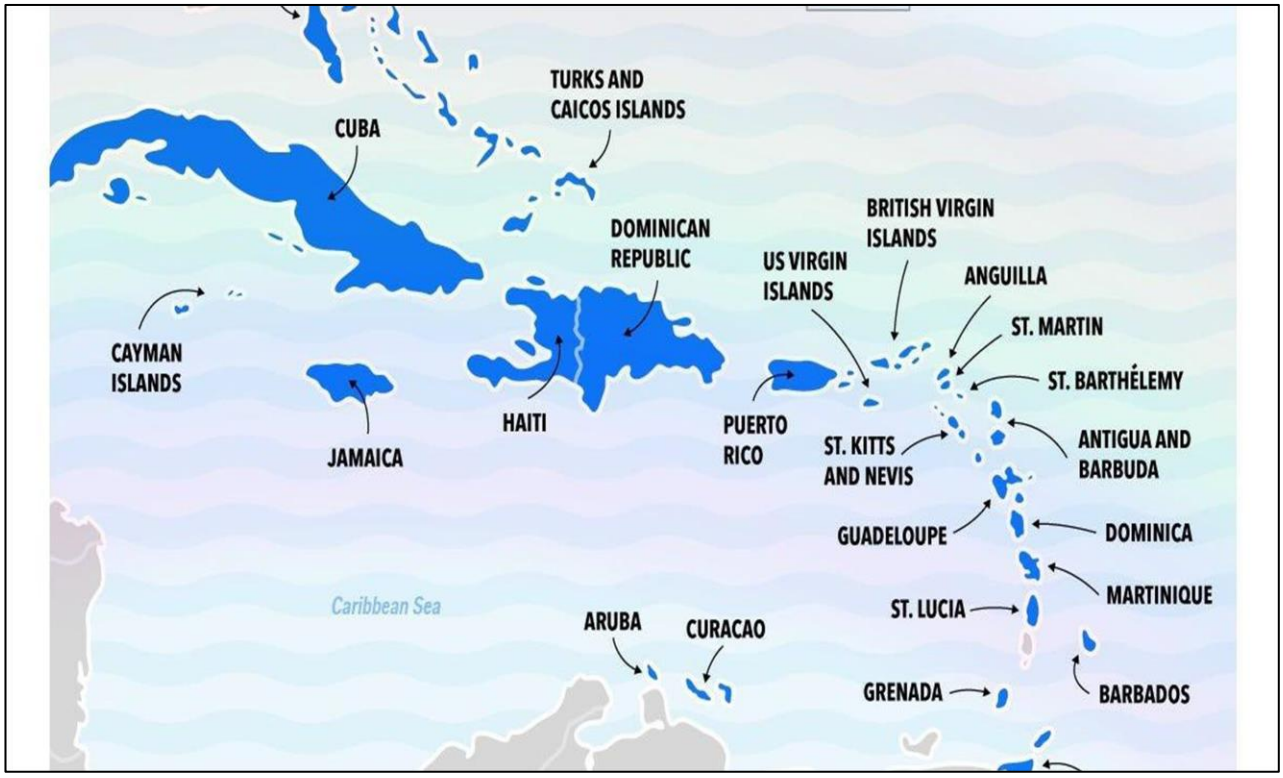
Chapter 1
National Circumstances

1.1 Geography and History

The Federation of Saint Christopher (hereafter, St. Kitts) and Nevis with a combined area of 104 square miles (269 square kilometres, is a twin island state located in the Lesser Antilles of the Eastern Caribbean Sea. St. Kitts, the larger of the two, is located at latitude 17015' north and longitude 62045' west and Nevis is located two miles (3 km) to the south-east, at 170 10' north and longitude 62035' west.

With a two-mile channel separating the land masses, St. Kitts and Nevis are located at the northern part of the Leeward chain of islands; approximately two hundred fifty miles (402 kilometres) southeast of Puerto Rico. St. Kitts is twenty-three miles (thirty-seven kilometres) at its greatest length, with an approximate area of sixty-eight square miles (176.8 square kilometres). Nevis is thirty-six square miles (93.6 square kilometres) and is almost circular in its configuration. Figure 1 shows a location map of St. Kitts and Nevis

Figure 1.1: Location of St Kitts and Nevis



The islands are the summits of a submerged mountain range that forms the eastern boundary of the Caribbean Tectonic Plate (MOE, 2001). The physical landscape of St. Kitts is characterized by three volcanic centres and ranges. The first is the central northwest range, dominated by Mt. Liamuiga, which rises with a pronounced crater to 1,156 meters (3,792 ft.). It is the highest peak in St. Kitts and Nevis. The middle range is dominated by Verchild's mountain at 975 m, but otherwise consists of a number of irregular peaks. The southeast range has a number of irregular peaks with the highest at 900 m. The slopes of the latter two ranges are steeper and shorter on the leeward coast and the land near the coast is typically flat or moderately sloped; and hence the site of most development (MOSD, 2007).

Nevis Peak is the highest point on Nevis rising to about 985 meters (3,232 ft.) Round Hill is the second highest point on the island with an elevation of approximately 303 meters (990 ft.)

The slopes are cut by deep gullies or ghauts that act as the primary drainage channels (MOE, 2001), but they are almost entirely dry for most of the year. Only the relatively large Wingfield and Cayon rivers flow to the sea for much of the wettest part of the year (DOE, 2001).

Figure 1.2: Saint Kitts and Nevis

St. Kitts was inhabited by the Amerindian people called Arawaks. The Arawaks entered the Caribbean from South America about two thousand years ago and by AD 1500 had occupied all of the islands of the Caribbean as far north as The Bahamas and as far west a Cuba. They were followed at a much later date by a more war like people called the Caribs (Dyde 2008).

The Carib Indians called the island of St. Kitts "Liamuiga" which means fertile land. Christopher Columbus sailed past St. Kitts on his second voyage on 13th November 1493. St. Kitts was named San Jorge and Nevis was named St. Martin. The names were later changed by Spanish sailors to what they are today and by the early sixteenth century the names San Cristobal, St. Christopher and Nevis, remained Spanish colonies for over a century; however, they were never really settled by the Spanish colonizers, as they were more interested in the Greater Antilles of the Caribbean and Central America. St. Christopher and Nevis also had a sizeable Carib population. During the late sixteenth century St. Christopher and Nevis became extremely popular with English, Dutch and French born sea raiders.

Table 1.1: Chronology of Significant Historical and Political Events

Year	Event
1493	Christopher Columbus lands on the islands and names St Kitts after his patron saint, Christopher
1623	The British establish their first Caribbean colony on St Kitts
1626	The British massacre 2,000 indigenous Caribs
1628	The British establish a colony on Nevis
1783	France relinquishes claims on St Kitts in the Treaty of Versailles
1871	St Kitts, Nevis and Anguilla united as a British dependency
1980	Anguilla granted a constitution and its union with St Kitts and Nevis formally
1983	St Kitts and Nevis jointly attain independence within the British Commonwealth with Kennedy Simmonds as prime minister.
1994	A state of emergency is declared after anti-government riots by Labour Party supporters in the capital, Basseterre.
1995	Prime Minister Kennedy Simmonds loses in a general election which he had called following a scandal involving allegations of drug smuggling; Labour Party leader Denzil Douglas becomes prime minister.
1997	Nevis legislators authorise a referendum on the issue of whether the island should secede from St Kitts.
1998	August - Referendum on Nevis independence fails to achieve the two-thirds majority required for the island to secede.
1998	September - Hurricane George strikes
2000	Denzil Douglas begins a second term as prime minister after his Labour Party wins a majority of seats in a general election.
2003	March - Largest hotel complex in the eastern Caribbean opens on Frigate Bay, St Kitts.

2004	October - Denzil Douglas begins a third consecutive term as prime minister.
2005	March - Government decides to close the 300-year-old, loss-making sugar industry after the 2005 harvest.
2015	February - The Team Unity coalition wins elections, ending the former ruling Saint Kitts and Nevis Labour Party's 20-year reign
2020	June – The Team Unity coalition wins elections to a second five-year term.

1.2 Government System and Political Structure

St. Kitts and Nevis is a federal state that is patterned after the British Westminster-style parliamentary system of government. The distinctiveness of its 1983 Constitution provides for the autonomy of Nevis with regard to certain "specified matters" and the establishment of a separate Nevis Island Assembly (legislature) to govern local concerns. As a constitutional monarchy within the Commonwealth of Nations, St. Kitts and Nevis recognizes Queen Elizabeth II or her successor as the symbolic head of government with the Governor General as her resident representative. Although legally responsible for the government of both islands, the Governor General appoints a deputy to represent him or her on Nevis.

As the highest executive authority on the islands, the Governor General appoints the Prime Minister, the deputy Prime Minister, other ministers of the government, the leader of the opposition in Parliament, and members of the Public Service Commission and Police Service Commission. The Governor General has the authority to and may prorogue or dissolve Parliament at any time. However, as is the case in most Commonwealth countries, the nature/scope of the Governor General's powers is restricted by the requirement that he or she acts only in accordance with the advice of the Prime Minister.

The federal government of St. Kitts and Nevis is directed by a unicameral parliament known as the National Assembly; established by the 1983 Constitution to replace the House of Assembly. Presently the assembly consists of eleven elected members, or representatives, and three appointed members, or senators. Two of the senators are appointed by the governor general on the advice of the prime minister. The other is named on the advice of the leader of the opposition. Both representatives and senators serve five-year terms.

The focus of effective power in the federal government is the Cabinet of Ministers, which is chaired by the Prime Minister and consists of other ministers drawn from the membership of the Assembly (either representatives or senators). The Cabinet determines the business and policies of government. According to the Constitution, the Cabinet is "collectively responsible to the National Assembly," but because its members are drawn from that body, there is little likelihood of serious disagreement between the two.

Electoral districts, or constituencies, are delimited by the Constituencies Boundaries Commission. A

minimum of eight constituencies on St. Kitts and three on Nevis is mandated by the Constitution. Boundaries are not established solely on the basis of population; the commission is charged to consider other factors, such as population density, fair representation for rural areas, communication differences, geographical features, and existing administrative boundaries (areas of local administration) for which the Nevisian legislature (five may amend or revoke provisions passed by the National Assembly). There are twenty-three specified matters, including agricultural regulations, the borrowing of monies or procurement of grants for use on Nevis, water conservation and supply, Nevisian economic planning and development, housing, utilities, and roads and highways. Nevis's secession from the Federation requires a two-thirds vote in the NIA and the approval of two-thirds of the voters in a referendum. St. Kitts has no corresponding right of secession.

The island of Nevis elects representatives both to the National Assembly and to its own Nevis Island Assembly (NIA); a separate eight-member body elected, three appointed) charged with regulating local affairs. The NIA is subordinate to the National Assembly with regard to external affairs and defence and in cases where similar but not identical legislation is passed by both bodies. The guidelines for legislative autonomy in Nevis are contained in the "specified matters"

The Nevis Island Administration closely parallels the structure of the Federal government and has a Premier, an Assembly incorporating both elected and appointed members, and a body functioning as a local Cabinet. The Cabinet is chaired by the Premier and includes two or more members of the NIA. Disputes between the Nevis Island Administration and the federal government must be decided by the High Court.

The High Court sits in Basseterre and is the final Court of Appeal in the Federation. Appeals beyond the High Court are heard by the Court of Appeal of the Eastern Caribbean States Supreme Court. Further appeals beyond that level may be taken to the Judicial Committee of the Privy Council in London; but only if they conform to certain prescribed conditions, such as issues that require constitutional interpretation or are decisions of "great general or public importance." Local Magistrate's Courts provide summary jurisdiction.

Traditionally, parishes provided administrative boundaries; nine (9) on St. Kitts and five (5) on Nevis. Today the significance of parishes has been eroded through the increased reliance on constituency boundaries as a factor in the appropriation of public sector investments. Figure 3 below shows the parish boundaries for St. Kitts and Nevis.

Figure 1.3: Map showing pariah boundaries for St. Kitts and Nevis

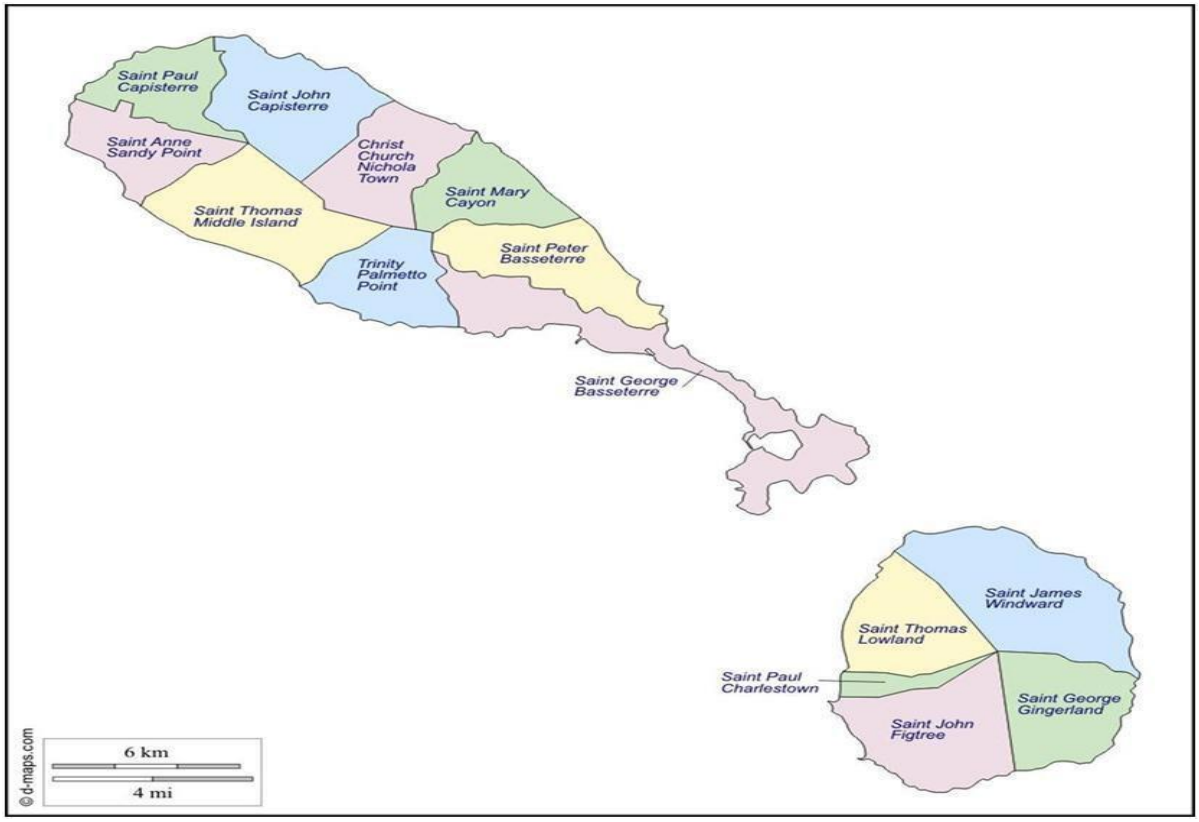


Table 1.2: Chief Minister, Premiers and Prime Ministers of St. Kitts and Nevis

Chief Ministers of St Kitts and Nevis (1960–67)		
	Time in Office	Political Party
Honourable Paul Southwell	January 1960-July 1966	St Kitts and Nevis Labour Party
Right Honourable Robert Bradshaw	July 1966- February 1967	St Kitts and Nevis Labour Party
Premiers of St Kitts and Nevis (1967–83)		
Right Honourable Robert Bradshaw	February 1967-May 1978	St Kitts and Nevis Labour Party

Paul Southwell	May 1978- May 1979	St Kitts and Nevis Labour Party

Lee Moore	May 1979- February 1980	St Kitts and Nevis Labour Party
Right Honourable Dr. Kennedy Simmonds	February 1980-September 1983	People's Action Movement
Prime Ministers of St Kitts and Nevis (1983–present)		
Right Honourable Dr. Kennedy Simmonds	September 1983- July 1995	People's Action Movement
Right Honourable Dr. Denzil Douglas	July 1995-February 2015	St Kitts and Nevis Labour Party
Dr. The Honourable Timothy Harris	February 2015 -present	People's Labour Party

1.3 Climate

St. Kitts and Nevis's climate is generally classified as tropical marine, and for the most part is influenced by the northeast trade winds and tropical oceanic cyclonic movements. Atmospheric conditions are pleasant as warm temperatures are modified by constant sea breezes. Variations in seasonal temperatures are insignificant with a mean annual temperature of approximately 27ºC (80.6ºF). The average temperature at Basseterre and at Charlestown is 27.8ºC (81.7ºF). Only at higher elevations do temperatures drop below 17ºC (62.6ºF). Lower temperatures are usually recorded in winter months (January to April).

The rainfall type is mainly relief/orographic and increases in amount and frequency with altitude. The central mountain range uplift effect produces an annual average of 64 inches (1,625 mm). Mean annual rainfall ranges from about 40 inches (1,016mm) in the coastal areas, to about 150 inches (3,810mm) in the mountain interior. The relative humidity level is usually low in the dry season and high in the wet season. The mean value is 76 percent but ranges from 70% in March to around 78% in September, October and November.

There is an observed uneven monthly and annual distribution with a generally reliable wet period between August and September. The driest months are from January to April. The very low rainfall together with high evaporation-transpiration rate contributes to the overall dry conditions as is evidenced annually by the desiccation and shrinking of terrestrial water bodies.

The prevailing wind is the north-east trade with mean speeds ranging from 10-20 miles per hour

(mph). The periods of seasonal low-pressure July - September have higher wind speeds of 20-30 mph. The regional pattern is locally modified by land and sea breezes. The hurricane season extends from June to November, and there is a high annual frequency of tropical disturbances which generate squalls and high wind velocities. Some of the major hurricanes that have affected St. Kitts are shown in table 1.3 below.

The economic, social and environmental impacts of tropical storms and hurricanes in Small Island Developing States economies such as St. Kitts and Nevis can be devastating; especially given the dependence on tourism. Table 1.4 identifies several storms that would have significantly impact the economy of the Federation.

Table 1.3: Tropical Storms and Hurricanes impacting St. Kitts and Nevis 1950-2017

Year	Hurricane/ Tropical Storm	Year	Hurricane/ Tropical Storm
Aug 1950	Hurricane BAKER	Jul 1996	Hurricane BERTHA
Sep 1950	Hurricane DOG	Sep 1998	Hurricane GEORGES
Sep 1953	Tropical Storm EDNA	Oct 1999	Hurricane JOSE
Jan 1954	Hurricane ALICE	Nov 1999	Hurricane LENNY
Aug 1956	Hurricane BETSY	Aug 2000	Hurricane DEBBY
Aug 1959	Tropical Storm EDITH	Sep 2004	Tropical storm JEANNE
Sep 1960	Hurricane DONNA	Dec 2007	Hurricane OLGA
Oct 1963	Tropical Storm HELENA	Oct 2008	Hurricane OMAR
Jul 1979	Tropical Storm CLAUDETTE	3 Sep 2009	Hurricane ERIKA
Sep 1979	Tropical Storm FREDERIC	Aug 2010	Hurricane EARL
Sep 1981	Tropical Storm GERT	Sept 2010	Hurricane IGOR
Sep 1989	Hurricane HUGO	Aug 2011	Tropical Storm EMILY
Aug 1995	Tropical Storm IRIS	Oct 2012	Hurricane RAFAEL
Sep 1995	Hurricane LUIS	Oct 2014	Hurricane GONZOLO
Sep 1995	Hurricane MARILYN	Aug 2017	Hurricane IRMA
		Sept 2017	Hurricane MARIA

Table 1.4: Select Hurricanes in St. Kitts and Nevis and Economic Impact

Date of Event	Number of People Affected	Deaths	Economic Impact (US$ Millions)
Sept 1989- Hugo	1,300	1	46
September 1995- Luis	1,800	0	197
Sept 1998- Georges	10,000	5	400

November 1999- Lenny	1,180	0	41.4
August 2017- Irma	xx	0	19.6
September 2017- Maria	xx	0	32.8

1.4 Ecology

St. Kitts and Nevis, like other islands in the Caribbean has had much of its virgin forest cleared mainly for agriculture. While the peaks are still covered with some forest, they do not show the typical virgin forest characteristics. Since the closure of the sugar industry on St. Kitts, it has been observed that vegetation succession has been taking place particularly on the lower slopes. The emergence of secondary vegetation on the former sugar lands represents an expansion in secondary forest cover. The lowlands on both islands are intensely used for development or farming. In the past, the increasing demand for agricultural land resulted in the clearing and cultivation of the upper slopes, which in turn has led to soil erosion and sedimentation of rivers and the near shore coastal areas. The closure of the sugar industry and the subsequent availability of land at lower elevations for agricultural expansion have minimized the risk of land degradation on steep slopes.

Vegetation on SKN can be classified into four distinct zones as shown in table 1.5 below. Table five shows the vegetation types.

Table 1.5: Vegetation/Forest Diversity of St. Kitts and Nevis

Vegetation Zone	Description	Vegetative Types
Halophytic	Coastal Location Mangroves & Wetlands	Coconut Palms Sea Grape Seaside Mahoe Manchineel Indian Almond Tamarind Sea Lavender Mangrove Trees Water Lillies
Xerophytic	Dry Woodland Grassland Cactus Shrub	Button Mangrove Braceletwood White Cedar Fleshy Herbaceous Aloes and Herbs Wild Frangipangi Casha

Cultivated Belt	Fertile Native and Introduced Plants Agriculture Crops	
Mesophytic	Mountain Forest	Ferns Mountain Cabbage Farm Spiny Palm Spaniah Ash Wild Mango Orchids Bromeliads

Table 1.6: Vegetation Types in St. Kitts and Nevis

Vegetation Type	Common Name	Scientific Name
Shrubs	Sugar Apple Soursop Castor Oil Plant Indigo Barbados Cherry Barricada Bush	Annona squamosa Anonas muricata Ricinus communis Indigofera suffruticosa Malpighia emarginata Jatropha gossypifolia
Medicinal Herbs	White top Rabbit meat Donkey rub down Broom White lady Nutgrass	Parthenium hysterophorous Leonotis nepetifolia Rhynchosia minima Sida spp Thunbergia fragans Cyperus rotendus
Seasonal Herbs	Onion Chives Thyme	Allium cepa A. Schoenoprasm L. Thymus vulgaris
Root & Tuber Crops	Sweet potato Dasheen Yam Cassava Tannia Eddoe	Ipomea batatas Colocasia esculenta Dioscorea alata Manihot esculenta Xanthosoma sagittifolium Colocasia sp.
Legumes	Peanuts String beans Pigeon peas	Arachis hypogaea Phaseolus vulgaris Cajanus cajan

Trees	Flamboyant Frangipani plant Boabab Tree Cashew Saman Pawpaw Hog Plum Glirriciddy Banana Mango Pineappe Avocado Grapefruit Orange Lime Breadfruit Wax apple Indian jujube	Delonix regia Plumeria rubra Adasonia digitata Anacardium Occidentale Samanea saman Carica papaya Spondias mombin Gliricidia sepium Musa L. Mangifera indica cv Julie Ananas cmosus Persea Americana Citrus. sinesis Citrus paradist Citrus. aurantifolia Artocarpus altillis Syzgium samarangense

The Biodiversity Review of St. Kitts and Nevis "Report on Rapid Assessment of Causes and Consequences of Biodiversity Loss" was prepared as part of the revision of the 2004 NBSAP. This Report detailed the number of terrestrial, aquatic and marine faunal species recorded in SKN. These are summarized in the table 1.7 below.

Table 1.7: Summary of SKN's Faunal Biodiversity

Species Type	Number of Species	Examples
Seabirds	9	Brown Pelican, Brown Booby, Frigate Bird, etc
Shorebirds	24	Great Blue Heron, Cattle Egret, Spotted Sandpiper, etc
Terrestrial birds	44	Rock Dove, Red-necked Pigeon, Ground Dove
Mammals	15	African Green Vervet Monkey, Cattle, Sperm whale, etc
Reptiles & Amphibians	14	Green Turtle, Ground Lizard, Mountain Chicken, etc
Invertebrates	17	Millepede, Red Dragon Fly, Caribbean Cray Fish

Marine & Aquatic - Demersal	9	Doctor Fish, Grunts, Snapper, etc

Coastal pelagic Ocean Pelagic	3 4	Gars, Ballahoo, Jacks. Dolphin, Tuna, Mackerel, Conch

[1]Generally marine water quality conditions for St. Kitts and Nevis are acceptable with the near shore benthic conditions favouring the growth of pelagics. Seagrass communities are common along the Atlantic Coast of both islands (particularly at the Southeast Peninsula). In general, beach deposits indicate a littoral drift rather than direct beach deposits. Sea grass communities perform several functions including the following:

- Stabilizing the sea floor
- Providing food and habitat near shore pelagics and for other marine organisms
- Maintaining water quality
- Supporting local economies

[2]Sea floor areas devoid of sea grass tend to be more vulnerable to intense wave action from currents and storms. The extensive root system in sea grasses (which extends both vertically and horizontally) assists in stabilizing the substrate layer in a manner similar to the way land grasses prevent soil erosion on land. Without sea grasses to diminish the force of the currents the extent of beach and overall coastal erosion would be greater.

While some species, including the green sea turtle, graze directly on sea grass leaves, others use sea grasses indirectly to provide nutrients. Debris from bacterial decomposition of sea grass plants provides food for worms and crabs. Advanced decomposition releases nutrients such as nitrogen and phosphorus, which, when dissolved in water, are re-absorbed by sea grasses and phytoplankton.

Although sea grasses are ideal for juvenile and small adult fish for escape from larger predators, many in faunal organisms (animals living in soft sea bottom sediments) also live within sea grass areas. Species such as clams, worms, crabs, and echinoderms, like starfishes, sea cucumbers, and sea urchins, use the buffering capabilities of sea grasses to provide a refuge from strong currents. The dense network of roots established by sea grasses also helps deter predators from digging through the substratum to find faunal prey organisms. Sea grass leaves provide a place of anchor for seaweeds and for filter-feeding animals like sponges and forams.

As with seagrass communities, coral reefs are important to the overall health of the near-shore

[1] Island Planning Services, EIA Report Friar's Bay Development

[2] Island Planning Services "Report on Rapid Assessment of Causes and Consequences of Biodiversity Loss"

marine ecosystem in St. Kitts and Nevis. Coral reefs provide habitat for the vast majority of sea floor dwelling or demersal species in the Caribbean. The fringing reef system on the Atlantic coast of St. Kitts and Nevis is relatively shallow compared to the deeper barrier reef system on the Caribbean coasts. Wilcox (1989) indicated that the fore-reef and the reef flat/crest of the Atlantic coast fringing reef system consisted mainly of rubble, with less than 5% living coral.

Common fish species found within the waters of the Federation include hind (Serranidae), parrotfish (Scardae), grunt (Pamadosydae), surgeonfish (Acunthuridae), sharks (Elasmabranchii), swordfish (Xiphias gladius), snappers (Lutjandae), groupers (Serranidae), and the Caribbean spiny lobster (Panulirus argus).

The importance of the marine ecology to St. Kitts and Nevis is further highlighted as several beaches provide habitat for turtle nesting. There are three main species of turtles that nest and or feed on the beaches and in the waters around the islands. These are the Hawksbill (Eretmochelys imbricate), Green (Chelonia mydas) and Leatherback turtles (Dermochelys coriacea). The Hawksbills and Greens feed primarily in the coastal areas of the Southeast Peninsula and are generally found in these waters year-round. Greens feed primarily in sea grass beds while Hawksbills feed primarily on coral reefs. Leatherbacks activity is restricted to the laying of eggs by adult females on the beaches.

Eckert (1989) identified several beaches on St. Kitts where turtle nesting took place but noted that only a few were significant habitats. This observation is supported by the St. Kitts Sea Turtle Monitoring Network (SKSTMN). The SKSTMN and the Nevis Turtle Group (NTG) are community based non-profit organizations that were founded in 2003. Both organizations monitor nesting sea turtle populations and act as an advocate for the strengthening of sea turtle protection laws. The organizations work in conjunction with several local, regional and international agencies including the St. Kitts Fisheries Department, St. Christopher Heritage Society, WIDECAST, UNESCO Small Islands Voice, Ross University School of Veterinary Medicine, the Georgia Sea Turtle Center, St. Catherine's Island Center, University of Illinois School of Veterinary Medicine & local citizens to develop a long-term sea turtle monitoring & protection program.

The main threats to turtles throughout St. Kitts include predation of eggs and hatchlings from mongoose, human poaching of eggs, over catch of turtles during the harvesting season for meat, habitat degradation through development activity, and coastal and sea borne pollution. The objectives of the SKSTMN are to implement, under the direction of the St. Kitts Department of Marine Resources, a long-standing sea turtle conservation management program, and to promote community awareness of the plight of sea turtles.

Consequences of Biodiversity Changes

Diversity at all organizational levels, ranging from genetic diversity within populations to the diversity of ecosystems in landscapes, contributes to global biodiversity. However, for the purposes of this report the discussion here is focused on species diversity, because the causes, patterns and consequences of changes in diversity at this level are relatively easily observed and documented.

Species diversity has functional consequences because the number and kinds of species present determine the organism traits that influence ecosystem processes.

The quality and character of species traits may mediate energy and material fluxes directly or may alter abiotic conditions within an ecosystem. Limiting resources, habitat disturbance and microclimate changes regulate process and production rates that are vital for ecosystem functioning. The universal aspects of species diversity that determine specie characteristics include the following:

- Number of species present (species richness),
- Relative abundances (species evenness),
- Particular species present (species composition),
- Interactions among species (non-additive effects), and
- Temporal and spatial variations in these properties.

Changes in biodiversity alter the functional traits of species in an ecosystem in ways that directly influence ecosystem goods and services. Influences might be positive (for example, increased agricultural, fisheries or forestry production) or negative (for example, loss of harvestable species or species with strong aesthetic and cultural values). Variations in species traits affect ecosystem processes directly through changes in biotic controls and indirectly through changes in abiotic controls, such as availability of limiting resources, disturbance regime, or micro/macroclimate variables.

Changes in the profile of biodiversity of SKN may alter ecosystem processes and adversely impact the resilience of ecosystems to environmental change. This has profound consequences for the goods and services that residents of and visitors to SKN derive from the environment. The wider ecological and societal consequences of a changing biodiversity should be minimized to preserve options for future solutions to local, regional and global environmental problems.

The following effects and relationships that impact biodiversity have been observed in SKN, more visible since the closure of the sugar industry.

- Vegetation succession (from sugar cane to guinea grass and shrubbery mainly) is causing a retreat of the forest line in some areas because of grass fires. Grass fires also adversely impact arboreal species (habitat loss and disturbance) and soil organisms.
- Observed increases in the mongoose population, particularly on the Southeast Peninsula have resulted in an observed decline in birdlife in that landscape as the mongoose eats the bird eggs.
- Dramatic increases in the monkey population throughout SKN severely impacts agricultural output and profitability as they destroy crops. Like the mongoose, monkeys also disturbs breeding and nesting sites for birds; a factor that affect pollination.
- Land allocation, mainly for resort development throughout SKN has resulted in changes in several sensitive ecosystems. Land preparation activities including but not limited to

dredging, infilling, excavation and grading have led to the removal of plants and habitat disturbance (both aquatic and terrestrial).

- Land based sources of pollution carried by storm water runoff into the near shore marine environment affects water quality and the health of coral reefs. The net result has been an observed reduction in near shore pelagic.

Population

St. Kitts and Nevis is scheduled to conduct its population census in September 2021. It will be the first time that the census will be administered using the Computer Assisted Personal Interview (CAPI) platform.

[3]Based on the latest United Nations estimates, the current population of St. Kitts and Nevis is approximately 53,082 or 0.00068% of the total World's population. The population density in St. Kitts and Nevis is 205 per square kilometre or 530 persons per square mile. Tables 1.8 and 1.9 below show the estimated and projected population dynamics for the period 2015 to 2020 and 2020-2050 respectively.

Table 1.8: Population Projections of St. Kitts and Nevis (2015-2020)

Year	Pop.	Yearly %	Yearly Change	Density (P/Km^2)	Urban Pop	Urban Population
20	53,199	0.77 %	399	205	32.9 %	17,523
20	52,823	0.73 %	382	203	32.9 %	17,354
20	52,441	0.76 %	396	202	32.8 %	17,188
20	52,045	0.81 %	420	200	32.7 %	17,031
20	51,625	0.82 %	422	199	32.7 %	16,879
20	51,203	0.88 %	437	197	32.7 %	16,736

Source: United Nations, Department of Economic and Social Affairs, Population Division

Table 1.9: Projected Population increase for St. Kits and Nevis (2020-2050)

Year	Pop.	Yearly % Change	Yearly Change	Density (P/Km^2)	Urban Pop %	Urban Population
202	53,19	0.77%	399	205	32.90%	17,523
202	54,74	0.57%	308	211	33.80%	18,481
203	55,83	0.40%	218	215	35.20%	19,645
203	56,49	0.23%	132	217	37.20%	21,042
204	56,73	0.08%	48	218	39.90%	22,617

[3] Extract from World Population Prospects (2019 Revision)

204	56,61	-0.04%	-24	218	42.60%	24,135
205	56,16	-0.16%	-90	216	45.50%	25,561

Source: United Nations, Department of Economic and Social Affairs, Population Division

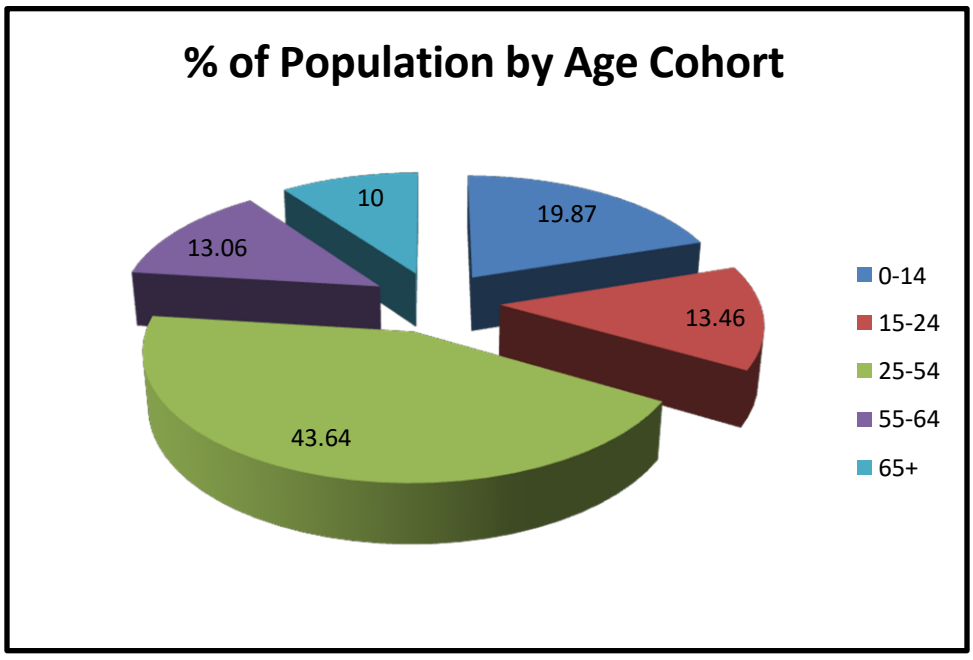
Table 1.10 and figure 1.4 below provide an overview of some demographic features of the population. The following are some key observations:

- There is no significant difference in the gender distribution.
- Almost 50% of the population falls within the age cohort (25-54), with another 13.46% within the age range of 15-24.
- There is a relatively low dependency.

Table 1.10: Age Structure of St. Kitts and Nevis Population

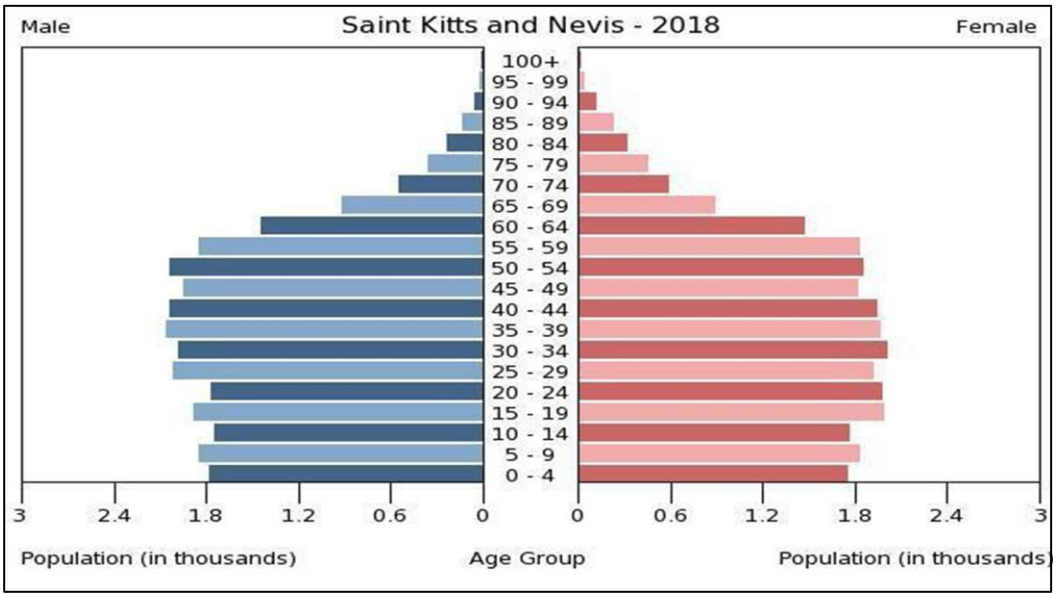
Age Cohort	% of Population	Males	Females	Total
0-14	19.87	5357	5336	10693
15-24	13.46	3504	3741	7245
25-54	43.64	12010	11477	23487
55-64	13.06	3527	3485	7012
65+	10	2540	2844	5384
Total		26938	26883	53821

Figure 1.4: Chart showing population distribution by age cohort



The population pyramid for St. Kitts and Nevis illustrates the age and sex structure of the population and provides some insights about economic, social and political stability of the country. The shape of the population pyramid gradually evolves over time based on fertility, mortality, and international migration trends.

Figure 1.5: Population pyramid for St. Kitts and Nevis (2018)



[4]The population of St. Kitts and Nevis is approximately made up of 92.5% of African descent, 3% mixed, 2.1% Caucasians, 1.5% East Indian, 0.6% other and 0.3% unspecified.

The religious profile is summarized as follows based on 2001 estimates:

- Protestant 74.4% (includes Anglican 20.6%, Methodist 19.1%, Pentecostal 8.2%, Church of God 6.8%, Moravian 5.5%, Baptist 4.8%, Seventh Day Adventist 4.7%, Evangelical 2.6%, Bretheren 1.8%, other .3%),
- Roman Catholic 6.7%,
- Rastafarian 1.7%,
- Jehovah's Witness 1.3%,
- Other 7.6%,
- None 5.2%,
- Unspecified 3.2%

The major urban areas are Basseterre and Charlestown. In St. Kitts, while the population is

[4] Department of Statistics, Ministry of Sustainable Development

concentrated in the capital and surrounding suburban areas, a considerable portion of the population is located in coastal areas, with many villages located along coastal roads. Nevis follows a similar pattern to St Kitts with the population being concentrated in and around Charlestown. Many of the villages in Nevis are located along the island's main road. The location of the population centres on the coast enhances the vulnerability of St. Kitts and Nevis to the impacts of climate change.

1.5 Economy

St. Kitts and Nevis is heavily dependent on revenues from the tourism industry and remains one of the fastest growing economies in the Eastern Caribbean; offering investment opportunities within the priority sectors as identified under the National Adaptation Strategy. These include financial services, tourism, real estate, agriculture, information technology, education services and limited light manufacturing.

[5]It is estimated that economic growth in 2018 increased to 2.5% from 1.2% in the previous year. Tourism was the main contributor, with the hotel and restaurants sector performing very well, followed by the transport, storage and communications sectors. Overnight arrivals increased by 4.2% year-on-year; helped by additional direct flights from Atlanta, New York and Miami. Cruise ship arrivals were also up. The room stock was enhanced by the first full year of operation of a new luxury Park Hyatt hotel.

Growth in the construction sector fell following the completion of this hotel in 2017. Major public investments included the construction of the East Line Bus Terminal, ongoing rehabilitation of the island main road, and the completion of construction of the second cruise ship berth (all in St. Kitts). The real estate and business activities sectors added very little to economic growth, as did the financial sector, which was burdened by high levels of nonperforming loans (NPLs).

According to the Eastern Caribbean Central Bank (ECCB), St. Kitts and Nevis had an estimated Gross Domestic Product of USD $787.8 million in 2016, with forecasted growth of 3.1 percent in 2017. The introduction of the People Employment Programme in 2012 (two years ago renamed and reorganised as the Skills Training and Empowerment Programme (STEP), has lowered unemployment significantly. No official unemployment data have been published since 2009, but according to the Government of St. Kitts and Nevis (GSKN) the STEP still employed 2,000 persons as of February 2018, giving major relief to the labour market.

Central Government's fiscal position improved following the introduction of a new Citizenship- by-Investment (CBI) option. The 2018 launch of the Sustainable Growth Fund led to a strong rise in CBI revenue flowing directly to the Consolidated Fund. GSKN achieved a primary surplus of $195 million (mn) – or 7.1% of gross domestic product (GDP) – and an overall surplus equivalent to 5.6% of GDP. While full-year data are not yet available for CBI receipts, inflows reached $287M – or 39% of total GSKN revenue – between January and September 2018. Total revenue rose 23.5%, mainly due to the CBI-driven 84.0% increase in

[5] Eastern Caribbean Central Bank County Review

nontax revenue, while tax revenue was just 8.0% higher. Total expenditure rose by 11.4%, as capital expenditure and net lending increased by 29.3%.

Total public sector debt as a percentage of GDP remained stable in 2018. The ratio of debt to GDP fell marginally from 58.4% to 58.2%. This partly reflected restructuring of a portion of the Nevis Island Administration's debt. Domestic debt represented 75.0% of total debt and the remaining 25.0% was foreign debt. New debt included the financing of the second cruise ship berth, as well as loans for the National Housing Corporation and a water drilling project in Nevis.

The capital account surplus increased from $91.8M to $140.2M, mainly because of stronger CBI inflows. These inflows also contributed to a $78.3M rise in international reserves.

The Caribbean Development Bank (CDB) projected an increase in growth to 3.0% in 2019, mainly on the back of expanding construction and tourism activities. Construction activity is expected to accelerate with ongoing public infrastructure investments at the St. Kitts airport and seaport, and on each of the islands' main roads. The strong 2018 CBI inflows and resulting construction activity in hotel and condominium projects, was expected to add to sector growth tin 2019.

GSKN targeted a lower primary surplus for 2019. Total revenue was expected to decline by 8.1% and total expenditure likely to grow by 5.7%, the primary surplus was projected to fall to 2.1% of GDP. The projected decline in revenue was due to a projected 29.1% drop in nontax revenue – mainly CBI receipts – although this will remain the main revenue category. On the expenditure side, capital expenditure was expected to increase by 21.8%, with one third of the funds being earmarked for improving the public infrastructure. Major proposed investments included the rehabilitation of the main roads on both islands, the upgrade to the airport on St. Kitts and the construction of the second cruise ship berth in St. Kitts, and the expansion of the hospital in Nevis.

The main risks to the macroeconomic and the fiscal outlook stemmed from external factors. The COVID-19 global pandemic has severely impacted growth across the economy of St. Kitts and Nevis; with the impact being most severe in the tourism industry. The pandemic has shifted the developmental agenda in St. Kitts and Nevis and has changed the timelines for the delivery of important capital projects. Nonetheless, St. Kitts and Nevis has engineered a framework which is helping to build economic resilience.

[6]Some of the economic relief and stimulus measures implemented by the Government to date includes:

[6] Ministry of Finance

- Provision of additional funds to support the Poverty Alleviation Programme (PAP)
- Provision of additional resources to capitalize the Severance Payment Fund
- Provision of $30 million in funding through the Development Bank of St. Kitts and Nevis for mortgage loans to citizens of St. Kitts and Nevis
- Moratorium on mortgages held with the National Housing Corporation (NHC) and the Development Bank of St. Kitts and Nevis
- Moratorium on payments for electricity services for April to June 2020 by the St. Kitts Electricity Company (SKELEC) and the Nevis Electricity Company (NEVLEC).
- Postponement of the payment of Property Tax from June to September 2020
- Reduction of the Corporate Income Tax rate from 33 percent to 25 percent for the period April to December 2020 for businesses that retain at least 75 percent of their employees
- Reduction of the Unincorporated Business Tax rate by 50 percent (from 4 percent to 2 percent) for the period April to December 2020
- Waiver of payments for consumption of water for April to December 2020 for individuals affected by COVID-19
- Waiver of payments for the consumption of water by farmers for nine months (April to December 2020)
- Removal of VAT and Import Duty on additional hygiene items such as hand sanitizers, disinfectant sprays, rubbing alcohol and latex gloves, and removal of Import Duty and Customs Service Charge on selected food items for nine months
- Continuation of the Fresh Start Programme with an injection of $5 million to provide access to capital to fund small and medium sized business projects
- Provision of additional financial resources to the Ministry of Health
- Provision of additional financial resources to the Ministry of Education

[7]As of November 2020, the Social Security Board had provided income support to displaced individuals in the amount of $22.6 million. The Government has also provided direct income support to thousands of recipients under the Poverty Alleviation Programme (PAP). The number of recipients peaked in May 2020 totalling of 4,873. Of this number, 940 households were added as a direct result of the impact of COVID-19 on their livelihoods. The Government of St. Kitts and Nevis expended $28.4 million on the PAP up to the end of November 2020. Other significant spend included $14 million on Health, Education and National Security and $6.5 million in the Agriculture Sector.

It is estimated further that taxes waived, and the impact of deferred taxes would be in excess of
$26 million. The National Housing Corporation provided breathing space for some 171

[7] Extracted from the St. Christopher and Nevis Budget Address 2021

homeowners for three months to the tune of $452,682 and the Development Bank of St. Kitts and Nevis assisted 351 of its clients at approximately $3.8 million.

According to the Eastern Caribbean Central Bank (ECCB) 1,717 loan recipients have accessed the moratorium facilities extended by commercial banks operating in the Federation during 2020. The value of the deferred loan facilities with commercial banks is in the region of $511 million. The economic outlook for the period 2021 to 2023 has projected the recurrent revenue to be approximately $724.2 million per annum while the average annual amount for recurrent expenditure would likely be in the region of $642.3 million.

Additionally, the medium-term Capital Expenditure projections are expected to average about $122.3 million per annum. It is anticipated that the fiscal operations of the Government would result, on average, in a recurrent account surplus of $81.9 million, an overall deficit of $25.4 million and a primary deficit of $8.6 million. Based on these projections, it is likely that the potential impact of the pandemic would require the Government to borrow in order to achieve its development objectives for 2021 and the medium term.

Table 1.11: St. Kitts and Nevis Economy at a Glance

	2015	2016	2017	2018	2019	2020
Real GDP Growth (%)	2.1	3.7	1.6	2.1	1.8	12.5
Average Inflation (%)	-2.6	1.5	1.5	-1.1	0.5	-2.0
Unemployment (%)	NA	NA	NA	NA	NA	NA
Primary Balance (% of GDP)	7.7	9.6	3.4	7.1		
Public Sector Debt (% GDP)	66.1	61.5	58.4	58.2	57.4	NA

Sources: ECCB, CDB, IMF, GSKN

1.6 Institutional and Legislative Framework

St Kitts and Nevis has a long history of addressing various aspects of sustainable development, particularly soil and water conservation. For the most part this history has been associated with the sugar industry; given that land management including conservation activities were integrated into the management of overall operations of the sugar estates. Today, the Ministry of Sustainable Development is primarily responsible for the sustainable land management in St. Kitts and Nevis.

The Ministry of Sustainable of Development was established in 2005 and became responsible the lands and surveys functions of the Ministry of Agriculture and Housing and the environment management portfolio from the Ministry of Health. As of 2015, the Ministry of Sustainable Development was restructured; the main change being the removal of the environment portfolio from the Department of Physical Planning and Environment to the Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlement.

A new Ministry of Environment and Cooperatives was created following the June 2020 General Elections. Its mission is to provide a framework to identify, consult, network, evaluate and build resilience to support sustainable livelihoods and the natural, built and cultural environments. The Ministry is committed to pursuing strategic and innovative partnerships locally, regionally and internationally with the view to create a roadmap for a safer and sustainable future.

[8]This Ministry provides strategic advice on and implements environment and relevant interrelated policies to achieve a safer and sustainable future. The key priority is to create an enabling environment in support of this vision. Coordinated and constructive collaborated partnerships are at the core of achieving inclusive, sustainable and resilient measures. The Ministry has embraced several cross- cutting issues in the face of changing climate patterns, the life changing impacts of natural phenomena particularly on the economic livelihood of vulnerable groups. This ministry has a significant role to perform in contributing to the achievement of the 2030 Sustainable Development Goals. Eight (8) SDGS of these goals fall within the remit of the Ministry.
These include:

Goal 6: Clean Water
Goal 7: Affordable and Clean Energy
Goal 9: Industry, Innovation and Infrastructure
Goal 11: Sustainable Cities and Communities
Goal 12: Responsible consumption and production
Goal 13: Climate Action
Goal 14: Life Below Water
Goal 15: Life on Land

The Ministry intends to place greater emphasis on heightened meaningful collaboration, national park development, exploring sustainable financing, strengthening the regulatory framework, policy development, risk management and sharpening digitally enabling skills.

Table 1.12: Table showing history of the DOE

Year	Line Ministry	Core Responsibilities
1996	Health & Environment	To meet its international obligations to various bi-lateral and multilateral economic and environmental agreements.

[8] Extracted from the Report on Plans and Priorities for the Year 2021 as part of the Budget Estimates.

2005	Sustainable Development	Focal point in St Kitts and Nevis for the United Nations Framework on Climate Change (UNFCCC), the United Nations Convention of Biological Diversity (UNCBD) and the United Nations Convention to Combat
2015 to 2020	Agriculture, Marine Resources, Cooperatives, Environment & Human Settlement	United Nations Framework on Climate Change (UNFCCC), the United Nations Convention of Biological Diversity (UNCBD), Montreal Protocol, Cartegena Protocol on Biosafety, Nagoya Protocol
2020 to Present	Ministry of Environment & Cooperatives	United Nations Framework on Climate Change (UNFCCC), the United Nations Convention of Biological Diversity (UNCBD), Montreal Protocol, Cartegena Protocol on Biosafety, Nagoya Protocol

The Ministry of Sustainable Development mandate is to provide sound, economic advice and related pertinent information that pave the way for the advancement of the government's economic, social and physical agenda. This is achieved by compiling, assessing and disseminating the requisite information that will allow Government and the private sector to develop, plan and carefully implement policies that will stimulate our economic growth and foster proper planning.

[9]During 2021, the Ministry will undertake new initiatives in: - Improving Environmental Management through Sustainable Land Management (SLM), identifying, assessing and developing the various communities island-wide in an effort to increase their sustainability in accordance with the UN Sustainable Development Goals and the mandatory St. Kitts and Nevis Population and Housing Census 2021. Ongoing projects through Government's revenue, New Land Distribution Programme, Commercial Infrastructure Development Project, National Museum Restoration Project, Construction of a Sustainable Development Building.

Presently, the Ministry of Sustainable Development includes the following departmental components:

- Administration,
- Economic Affairs and Public Sector Investment Programme,
- Physical Planning,
- Lands and Surveys
- Statistics

[9] Extracted from the Report on Plan and Priorities for the Year 2021 as part of the Budget Estimates

The Development Control and Planning Board is responsible for the review and determination of all building and development planning applications in St. Kitts. Additionally, the DCPB is responsible for land use zoning, review of environmental impact assessments and the design and implementation of development plans and broader national policy instruments such as the National Physical Development Plan (NPDP).

The NPDP provides the general framework for sustainable development in the context of land use planning. The purpose of the NPDP is to identify appropriate physical planning and land use strategies that allow for sustainable exploitation of the natural resource base and to direct the use of public sector and private industry resources for planned and orderly development. The DCPB addresses the broad sustainable development areas of:

- Agriculture and rural development,
- Environmental protection,
- Water resource management,
- Land use planning,
- Climate change adaptation
- Biological diversity conservation.

The Department of Economic Affairs and Public Sector Investment Programme is the main contact and coordinating office in the MSD for local, regional and international projects, and for lending and donor agencies such as the Caribbean Development Bank (CDB); Organization of American States (OAS); United Nations Development Programme (UNDP); United Nations Environment Programme (UNEP); the Global Environmental Fund (GEF); World Bank; and the European Union (EU).

This department prepares and manages the government's Public Sector Investment Programme (PSIP) through close collaboration with line ministries and statutory corporations. The PSIP directs the preparation of the capital budget and assists in ensuring a holistic approach to inter-ministerial and inter-departmental programming, so as to avoid duplicity.

Nevis has its own Department of Physical Planning, and Environment (DPPE) and it is responsible for land use planning, land conservation, and environmental management. In 2005 a draft Physical Development Plan was prepared for the island; which proposed land to be earmarked for various land use types including environmental conservation areas. Generally, the DPPE on Nevis works closely with the DOE on St. Kitts with regard to the meeting country obligations under the key MEAs and other physical planning, development and environmental initiatives.

The Water Services Departments (WSDs) for both islands are responsible for the identification, upkeep and protection of water supply sources on St. Kitts and Nevis. The WSDs work in close

collaboration with the DOE, DPP and DPPE.

The Departments of Agriculture (DOAs) for both islands develop policies and programmes related to agriculture. The DOAs are responsible for a range of services related to agriculture and rural development. Some of these include soil sampling and analysis, soil conservation, forestry, water conservation and integrated pest management.

The Public Works Departments (PWDs) oversee the design and project management functions for new and maintenance of existing public infrastructure, including buildings, roads, drainage, bridges, and culverts.

The Saint Christopher National Trust (SCNT) and the Nevis Historical and Conservation Society (NHCS) are civil society organizations that are involved in sustainable development decisions and matters affecting built heritage and conservation in St. Kitts and Nevis. The SCNT was founded in 2009 with the goal of preserving the national heritage of St. Kitts. The Trust evolved from the St. Christopher Heritage Society which was incorporated as a private company in 1994. The main objective of the SCNT is to promote the protection, conservation, interpretation and enhancement of the natural environment of St. Kitts, including its animals and plant life.

The NHCS was established in 1980 to conserve the natural, cultural, and historic resources of the island and adjacent marine areas. The society is a non-profit organization managed by an executive board. Since its inception the NHCS has instituted projects and policies designed not only to preserve Nevis' unique history and environment, but also to make that heritage accessible and intelligible to locals and visitors.

The National Housing Corporation (NHC) and the Nevis Housing and Land Development Corporation (NHLDC) and the Solid Waste Management Corporation (SWMC) play a role in sustainable development in St. Kitts and Nevis. The NHC on St. Kitts and the NHLDC on Nevis are responsible for the public supply of affordable shelter accommodation and related infrastructure. The SWMC is a statutory authority with the responsibility of developing solid waste management facilities for storage, collection, treatment and disposal of solid waste.

Legislative and Regulatory Framework

There are no specific legal instruments addressing climate change or sustainable development. However, there are a number of legislative and regulatory instruments that have direct and indirect linkages to sustainable development in St. Kitts and Nevis. These include:

- National Conservation and Environmental Protection Act, 1987

- Development Control and Planning Act, 2000.
- Nevis Development Control and Planning Ordinance 2005
- Solid Waste Management Corporation Act
- National Housing Corporation Act
- Whitegate Development Corporation Act, No. 15 of 1999
- Forestry Ordinance 1904
- Water Courses Ordinance 41/56
- Public Health Act No. 22 of 1969
- Pesticide and Toxic Chemicals Control Act 1999
- Agricultural Development Act 1973
- St. Kitts-Nevis Building Regulations, Code and Guidelines (No.7 of 2000) and
- Substances that Deplete the Ozone Layer (Control) Regulations (No. 06 of 2004)
- Fisheries Aquaculture and Marine Resources Act, 2016
- Biosafety Act No. 14 of 2012

The National Conservation and Environmental Protection Act (NCEPA) provides the legislative authority for the management and development of natural and historic resources in St. Kitts and Nevis. The NCEPA outlines a framework for the declaration of sensitive ecological and historic sites as protected areas. Areas chosen as protected areas under this piece of legislation must have the following purposes and objectives:

- to preserve the biological diversity of wild flora and fauna that may be endemic, threatened or of special concern, and the land and marine habitats upon which the survival of these species depends;
- to protect selected examples of representative or unique biological communities, both on land and on marine areas;
- to sustain natural areas important for the protection and maintenance of life support systems, and basic ecological processes including water recharge and soil regeneration; and
- to protect selected natural sites and scenic beauty of special scientific, ecological, historical or educational value, including sites that are already degraded and need protection for restoration or sites that may become degraded if not protected.

The purposes and objectives of NCEPA have linkages to climate change adaptation and other aspects of sustainable development. The Development Control and Planning Act, No. 14 of 2000 (DCPA) provides for the orderly and progressive development of land in both urban and rural areas of St. Kitts. It complements the NCEPA in that it provides for the protection of the environment and improvement of associated amenities. With regard to land use planning and management, the Act sets out the framework for the grant of development permission and for the design and implementation of a National Physical Development Plan (NPDP) to direct spatial development through time. Planning and development control functions include but are not limited to the following:

- review of building and development applications;
- zoning;
- review of EIAs; and
- Design and implementation of development plans.

Similar to the NCEPA the DCPA contains provisions that establish linkages to climate change adaptation.

On Nevis the Development Control and Planning Ordinance 2005 provides the legislative framework for the Nevis Island Administration to prepare physical development plans that would guide the development and management of land use on the island. It provides also for the exercise of development control, including building activities. The Ordinance has a similar scope to the DCPA on St. Kitts as it makes provisions also for the following:

- review of building and development applications;
- land use zoning;
- review of EIAs;
- design and implementation of development plans; and
- natural and heritage preservation.

The Water Courses and Water Works Ordinance (Cap 185 of 1956) establishes legislative and regulatory powers for the WSD on both islands to regulate the supply of water to consumers, prevent waste, misuse and pollution of water and control sanitation of watersheds. It addresses issues of water supply and protection of watercourses. The management of watersheds in St Kitts and Nevis is intricately linked with climate change mitigation and adaption strategies. Watershed management functions are shared between several agencies including the Water Services Departments; the Department of Physical Planning, Department of Environment; the Department of Physical Planning and Environment (Nevis); and the Departments of Agriculture.

The St. Kitts-Nevis Building Regulations, Code and Guidelines (No.7 of 2000) (often referred to as the Building Code) provides the regulatory framework for the management of construction and built developments. The scope of the Code applies to the construction of new buildings and structures, alterations, renovations, remodelling, demolitions, removal, relocation, maintenance and occupancy of existing buildings. The DCPA and the Nevis Development Control and Planning Ordinance are the main legislative instruments that guide the implementation of the Code. The Building Code has linkages to climate change adaptation and resilience.

The Substances that Deplete the Ozone Layer (Control) Regulations (No. 06 of 2004) shows the

commitment of St. Kitts and Nevis to meet its requirements under the Montreal Protocol. The Montreal Protocol is an international agreement that seeks to control the production and consumption of certain ozone-depleting substances. This regulation has linkages to climate change mitigation.

The International Trade in Wild Fauna and Flora Act, 2009 was passed to facilitate SKN's compliance with the obligations under the Convention on International Trade in Wild Flora and Fauna or CITES. This Act also has the objective of conserving and managing the wild flora and fauna of SKN.

The Biosafety Act was enacted in 2012 and addresses the movement, transit, handling and use of all genetically modified organisms that may have adverse effects on the conservation and sustainable use of biological diversity. SKN has also undertaken an Assessment of Capacity Building Needs and Country Specific Priorities in biodiversity management in 2010 as an enabling activity for the CBD. The main objective of this project was to examine ex situ and in situ conservation strategies for national biodiversity resources. The main outputs from this project were:

- Management Frameworks for Biodiversity Threat Mitigation in St. Kitts and Nevis
- Incentive Measures for the Promotion of Biodiversity Conservation in St. Kitts and Nevis.
- Implementation of General Measures for the Conservation and Sustainable Use of Biodiversity in St. Kitts and Nevis.
- St. Kitts and Nevis Second National Report on Biodiversity to the Convention on Biodiversity.
- A Compilation of Traditional Knowledge for the Protection and Conservation of Biodiversity in St. Kitts and Nevis.

A draft Biosafety (Amendment) Bill 2016 to amend the Biosafety Act, No. 14 of 2012 has been prepared and is awaiting passage in the National Assembly. Draft accompanying Biosafety Regulations have been prepared also to accompany the amended legislation.

Fisheries Aquaculture and Marine Resources Act, 2016 provides for the conservation, management, development and sustainable use of fisheries, aquaculture and marine resources of St. Christopher and Nevis. It also provides for the monitoring and control of fishing vessels within and beyond the country's territorial waters. It has repealed the Fisheries Act, 1984.

Under this piece of legislation, it is intended that all functions, duties and responsibilities will be exercised in a manner that is aligned with several principles including but not limited to the following:

- All natural living resources including the host environment are assets of the people and

should be developed and managed for the benefit of present and future generations.
- Fisheries resources are to be used sustainably toward achieving socio-economic benefits.
- Fisheries conservation and management measures should be based on best practices.
- The ecosystem approach to the management and development of fisheries and the general marine environment shall be applied.
- Marine biodiversity shall be maintained and enhanced

The general principles outlined in Section 5 of the Act are consistent with the Guidelines for Mainstreaming Biodiversity Conservation into National Development.

Policies and Plans

Sustainable development initiatives in SKN have been supported by primarily by financing provided by the Global Environment Facility (GEF) through the implementation of the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Convention on Biological Diversity (UNCBD).

As is the case with many Caribbean territories, the risk of accelerated land degradation as an environmental problem has become more apparent in St Kitts and Nevis following the 2005 closure of the sugar industry. This has led to the implementation of the Sustainable Land Management Plan (SLMP). The SLMP developed a set of draft sustainable land management strategies that are linked to climate change adaptation.

Several policy instruments and plans have been approved by GSKN. These include the following:

- National Climate Change Policy (2017)
- National Climate Change Adaptation Strategy – 2018
- Sixth National Report for The Convention on Biological Diversity (6NR)
- Fourth National Report on The Implementation of the Cartagena Protocol on Biosafety (4NR)
- St. Kitts and Nevis National Biodiversity Strategy and Action Plan (NBSAP) 2014-2020
- Centralized Integrated Information Management Systems (CIIMS)
- National Bio safety and Biotechnology Policy (Revised 2016)
- Climate Change Online Risk Assessment Tool (CCORAL)
- [10]The National Climate Change Policy 2017 provides the legal mandate and policy framework for development of the National Climate Change Adaptation Strategy for St. Kitts and Nevis.

[10] Adopted from the National Climate Change Policy (2017)

The NCCP provides overarching guidance for the creation of institutional mechanisms to enable low carbon and climate resilient development, in harmony with other sectoral policies, and for the implementation of adaptation and mitigation measures. The policy focuses on mainstreaming of climate change considerations into the national development agenda through:

- Strengthening existing institutional arrangements for systematic observations, research and climate change modelling including through cooperation with academia, NGOs and the private sector;
- Assessing sectoral vulnerability to climate change by conducting vulnerability analyses and formulating adaptation options, including technological application, in biophysical and socio-economic systems;
- Revising sectoral policies to include consideration of climate change impacts derived from vulnerability analyses;
- Revising national development plans to incorporate climate change vulnerability, impacts and adaptation options with a view to climate proofing new developments and retrofitting existing infrastructure, and strengthening climate resilience, particularly to extreme weather events and slow-onset adverse climate impacts; and
- Enhancing the resilience of natural biophysical systems to maximize ecosystem services such as the natural coastal defence.

[11]National Climate Change Adaptation Strategy (2018) provides guidance on priorities and appropriate measures for adaptation to reduce vulnerability to the impacts from climate change and build long term resilience in SKN. It emphasizes the need for an integrated approach that addresses the economic, environmental and social dimensions of climate change and identifies specific adaptation objectives and measures to address sectoral and cross-sectoral vulnerabilities at the macro level. The Strategy also provide mitigation co-benefits where possible, through prioritizing adaptation measures that minimize greenhouse gas emissions and enhance natural ecosystems functioning as carbon sinks.

The Strategy covers the period 2018-2030 and aims at operationalizing the policy directives outlined in the National Climate Change Policy of 2017. The strategy covers the period 2018-2030.

Sixth National Report for the Convention on Biological Diversity was submitted May 2019. The Report suggests that generally the country has been contributing to the achievement of the Aichi Biodiversity Targets (ABT). The national targets for SKN have been influenced and directed by the global “Aichi Targets”, which were adopted in 2010 under the Convention on

[11] Adopted from the National Climate Change Adaptation Strategy (2017)

CBD's 2011-2020 Strategic Plan. [12]The National Biodiversity Targets for St. Kitts and Nevis were developed through a process of consultation with relevant stakeholders. In developing the National Targets, the elements of related targets were merged into one, thus reducing the total number of targets to twelve. The selected targets were then finalized by a multi-sectoral National Biodiversity Steering Committee. A number of indicators were also developed which allow for assessing the level of achievement of each target during the implementation of the 2014-2020 NBSAP.

Fourth National Report on the Implementation of the Cartagena Protocol on Biosafety (4NR). The GSKN submitted its Fourth National Report in December 2019. The Report suggests that national measures for the implementation of the Protocol are partially in place. Although the GSKN has implemented several national bio safety measures including the drafting of regulations and guidelines; there remains the need to undertake initiatives that target the mainstreaming of bio safety into national biodiversity strategies and action plans and other policies. [13]Additionally, while there is permanent staff in place at the DOE to administer functions directly related to bio safety, there is no established mechanism for budget allocations for the operationalizing national bio safety measures.

[14]National Bio safety and Biotechnology Policy (Revised 2016) provides the framework to protect the natural biological resources and the health of the people of the Federation of St. Kitts and Nevis from the adverse effects that may arise from the development and application of biotechnology and its derived products, but not including pharmaceuticals. This will be achieved by:

- Regulating and monitoring the development and use of GMOs in St. Kitts and Nevis;
- Establishing criteria for assessing the risks associated with GMO use;
- Developing the capacity in St. Kitts and Nevis to effectively manage such risks;
- Promoting the establishment of collaborative links with regional countries and institutions on bio safety;
- Establishing mechanisms for assessing the benefits to be derived from GMO use; and
- Ensuring that public education, participation and consultation are part of the implementation of this policy.

The goal of the bio safety policy is to ensure an appropriate level of protection for the conservation of biological diversity and human health and wellbeing, in the development and application of modern biotechnology in the Federation of St. Kitts and Nevis.

[12] Extracted from the Revision of the National Biodiversity Strategy and Action Plan for St. Kitts and Nevis Under the United Nations Convention on Biodiversity (National Biodiversity Targets 2014).
[13] Extracted from the Fourth National Report on the Implementation of the Cartegena Protocol on Bio safety
[14] Adopted from the National Bio safety and Biotechnology Policy

St. Kitts and Nevis National Biodiversity Strategy and Action Plan (NBSAP) 2014-2020. [15]The NBSAP (2014-2020) provided an opportunity for the GSKN to mainstream biodiversity in the overall development process by setting new national targets, principles and priorities which are in line with the Aichi Targets on Biodiversity and the Strategic Plan on Biodiversity, 2011 – 2020. The NBSAP also focused on stronger institutional integration. It identified and examined how various provisions of key legislative, regulatory and policy instruments can better influence biodiversity management in SKN.

The Guidelines on Mainstreaming Biodiversity Conservation into National Development were developed as part of the 2014-2020 NBSAP preparatory process. They aim at providing direction to users (Development Regulators and Practitioners) to help them mainstream biodiversity conservation in development policies, plans, projects and activities. The Guidelines contain direction on mainstreaming biodiversity conservation in selected development themes and sectors. Strategies designed to give direction to biodiversity management at the national level in order to achieve the local and international targets and ultimately achieve the national goals have been included under each of the following themes/sectors:

- poverty reduction,
- agriculture and rural development,
- environmental protection,
- land degradation,
- water resource management,
- marine resources management
- land use planning, and infrastructure.

[16]Caribbean Climate Online Risk Assessment Tool (CCORAL) has been designed as an online support system to support climate resilient decision making. Among other things the CCORAL provides a platform for rapid screening, understanding climate influence and inter alia apply climate risk management process. It has been designed to engender a programmatic risk management approach to decision making. The Public Sector Investment Programme has adopted CCORAL in the screening of all Public Sector Capital Projects.

Other Policy Based Initiatives

In 2008 the GSKN established the Central Forest Reserve (CFR) as a protected area. The CFR covers an area of approximately 1250 acres and represents the last remaining stand of undisturbed tropical forest on the island of St. Kitts. Nevis Peak on the island of Nevis has been earmarked under administrative order to be declared a protected area. The objective of

[15] Adopted from the National Biodiversity Strategy and Action Plan (2014-2020)

[16] https://www.caribbeanclimate.bz/caribbean-climate-chage-tools/tools/

managing these protected areas is to protect and conserve important species of plants and animals which are endemic to SKN.

Under the IWCAM project, the GSKN has designated the lower coastal section of the Basseterre Valley as a protected area. The project sought to demonstrate the proper management and protection of a critical aquifer and well-field through a parallel process of mitigation of threats from contaminants, on-the-ground protection, and improved user-resource management.

Prior to the designation of the CFR and the lower coastal section of the Basseterre Valley as protected areas, Brimstone Hill National Park Fortress on St. Kitts and the Bath Hotel on Nevis were the only two effectively declared sites in the Federation. In 1999 the Brimstone Hill Fortress National Park was declared a World Heritage Site.

[17]The St. Mary's Biosphere Reserve has been established under the Man and the Biosphere Project and is an important site in term of biological diversity. St. Mary's is one of the first biosphere reserves of the Caribbean island countries and serves as an example of village participation in efforts to preserve the outstanding mosaic of natural and cultural landscape values. It has a combined terrestrial and marine surface area 4,040.27 hectares.

Additionally, in July 2010 the GSKN through the MSD formally commenced the implementation of the SLMP. The key project outputs included:

- Guidelines on Mainstreaming Sustainable Land Management into National Development.
- The Strategic Framework for Investment Planning and Resource Mobilization for Sustainable Land Management Interventions
- Review of Legislation, Regulation, Policy & Institutional Framework for SLM
- Report on knowledge Management for SLM: Databases on Land Use, Land Tenure, Land Degradation and Land Zoning
- SLMP GIS Training Needs Assessment
- Training Manual for Managing Land Resources in St. Kitts & Nevis

The Strategic Framework for Investment Planning and Resource Mobilization for Sustainable Land Management Interventions developed under the SLMP can be used to further sustainable development activities in SKN.

[17] www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/latin-america- and-the-caribbean/saint-kitts-and-nevis/st-marys

The major issues affecting the mainstreaming of climate change adaptation and broader sustainable development in St. Kitts and Nevis continue to be the following:

- There is no comprehensive national policy or plan that addresses sustainable development.
- The plans and policies are programme specific and need to better examine cross-cutting issues. Increased emphasis on sustainable development interventions to meet national development priorities should provide the supporting framework for the articulation of a national policy or plan.
- The Ministry of Sustainable Development provides a general institutional coordinating mechanism for sustainable development in SKN. However, there is need for greater inter agency cooperation and collaboration at the national level to make the model more effective.
- Data management systems for climate change, biological diversity and land degradation and other sustainable development indicators are inadequate. Additionally, insufficient research capacity affects the availability and quality of data that is relevant to sustainable development.
- Insufficient capacity for the design and management of sustainable development interventions.

Additionally, there is a large degree of public uncertainty on and understanding of climate change issues. Reducing the risk of disasters from climate change adaptation in SKN should involve the adaptation of a multi-hazard and iterative approach. Mainstreaming climate change adaptation will depend on the sector and the climate change impact of concern. Nonetheless, the following should assist in mainstreaming climate change interventions at the national level:

- Increasing the use of vulnerability and adaptation assessment in development activities;
- Reducing vulnerability to sustain livelihoods;
- Improving the management of climate-sensitive natural resources (water resources) and economic production systems;
- Promoting economic diversification to reduce over reliance on climate-sensitive primary sectors;
- Increasing the resilience of infrastructure and physical development;
- Restructuring risk profile and sharing through improved financial intermediation and mechanisms;
- Including climate change issues and adaptation into national policies, programmes and budgets;
- Strengthening information and communication on climate change effects and adaptation options;
- Enhancing inter-island cooperation to improve productivity and management of shared resources.

Chapter 2 Measurement, Reporting, and Verification (MRV) System

2.1 Introduction

National Climate MRV systems are defined by the measurement, reporting and verification of a countries' climate actions under its main functional components: GHG emissions, mitigation, adaptation, policies, and support. Understanding the interaction of the system inputs and the defined outputs of these components is integral to choosing and implementing feasible strategies and policies, analysing emission trends and the prioritisation of a Parties' limited resources when addressing climate change. In 2002, the basis for non-annex I reporting to the United Nations Framework Convention on Climate Change (UNFCCC) was established and defined. Developing country parties have strived since then to implement these systems whilst balancing their national priorities and ensuring that the process takes into account their national circumstances.
Today, through the Paris Agreement, defined more recently in the Glasgow Pact, Parties are required to implement the Enhanced Transparency Framework (ETF) with common reporting tables and common tabular formats (with flexibility provisions embedded for developing parties) to build mutual trust and confidence and promote the effective implementation of actions.
The Government of St. Kitts and Nevis has positioned itself on a path towards establishing an all-encompassing and comprehensive MRV system through its work during the current reporting cycle (TNC/BUR1) as well as previous climate change projects. Specific capacity building initiatives were prioritised and highlighted below:

- Capacity building of local experts to initiate the process of institutionalising memory and technical capacity in all reported sectors for the TNC/BUR1 to meet the demands of the new reporting requirements identified under the ETF. All selected regional/international consultants were required to provide training sessions in their reporting sector (Mitigation, GHG inventory, Adaptation, Gender, and Support) as part of their project output.
- Establishment of a National Climate Change Committee inclusive of the "set-up" of working groups in adaptation and mitigation.

Through the implementation of a National MRV system and continued prioritisation of capacity building actions for future reporting cycles, it is envisaged that this system will measure, report, and verify the following activities and actions in adherence with the Transparency, Accuracy, Completeness, Comparability, and Consistency (TACCC) principles that govern climate change reporting:

- Activities that cause climate change - Greenhouse Gas Inventory (GHGI)
- Mitigation policies and measures
- Actions taken that prevent climate change (mitigation actions and Nationally Determined Contributions (NDC) implementation and progress)
- Climate change impacts and adaptation

- Actions taken to adapt to climate change (adaptation actions and NDC implementation and progress)
- Financial, technology transfer and capacity building activities needed and received for undertaking the actions above.

2.2 Institutional arrangements related to MRV

Small Island Developing States (SIDS) member countries are widely considered to be some of the first countries to experience the adverse effects of climate change though they are amongst the least responsible in terms of global GHG emissions. St. Kitts and Nevis is a SIDS member country but has prioritised the need to provide the domestic and international community with the required reports highlighted in the Paris Agreement that adhere to the principles of transparency, accuracy, completeness, consistency, and comparability (TACCC) in an effort to demonstrate commitment and leadership in the climate change negotiations and reporting process; whilst using the information to guide domestic policy.

Due to limited institutional, human, and technical capacity within the identified domestic teams, St. Kitts and Nevis continues to face challenges in the reporting process as was previously identified during submission of their first and second national communications. To aid in the overcoming of these obstacles whilst prioritising continuous improvement, the Government of St. Kitts and Nevis engaged regional and international consultants to conduct the relevant planning and preparation activities to meet its reporting obligations as well as to conduct sensitisation and capacity building training in all reporting sectors to begin the process of institutionalising memory and technical capacity.

Analysis of previously submitted climate change reports (1st and 2nd NC and NDC) revealed a substantial loss of historical information (chosen calculation methodologies, activity data, expert judgement, and background justification) that hindered opportunities to revise/recalculate previous emission estimates, to extend the reporting timeseries to include missing years as well as improve reporting through the latest BUR reporting cycle. Previous reports were conducted using a decentralised, project based MRV system.

Cognisant of the issues faced during previous reporting cycles and an understanding of the necessary improvements to previous institutional arrangements (inclusive of data flows and communication channels), St. Kitts and Nevis used the opportunity of the BUR1 reporting cycle to begin the process of moving from a decentralised project-based system to a centralised project-based system. As highlighted earlier in the chapter and in an effort to achieve this goal, St. Kitts and Nevis prioritised the enhancement of technical and institutional capacity of the domestic team; through capacity building activities conducted by the different consultant teams during their identified action tasks required for the relevant reporting activities.

An example of this approach can be seen through the Greenhouse Gas Inventory (GHGI) and Mitigation Assessment/Chapter compilation process where regional consultants leading the technical aspects of the relevant reports worked in a collaborative manner with national experts; to undertake targeted training and provide guidance whilst gaining knowledge from the domestic

team on available activity data, input parameters for calculations and relevant national circumstances. Activities included GHGI compilation training, hands-on participation in data collection activities, and a UNFCCC quality assurance review during the GHGI compilation process. Mitigation activities included sensitisation and training on the development of the mitigation actions and the use of the Low Emissions Analysis Platform (LEAP) model. The mitigation actions also included a validation workshop where the results of the modelling and related actions were presented to all stakeholders to verify and accept the results.

Figure 2.1 below, represents the institutional arrangements for the development of St. Kitts and Nevis' 3rd National Communication (NC3) and 1st Biennial Update Report (BUR1) reporting process. The institutions and roles of the actors involved are described in Table 1 below to highlight the interactions between regional/international consultants and the domestic team during the preparation of the St. Kitts and Nevis National Inventory Report (NIR) and mitigation chapters.

Figure 2.1 Institutional arrangements for the Third National Communication and First Biennial Update Report

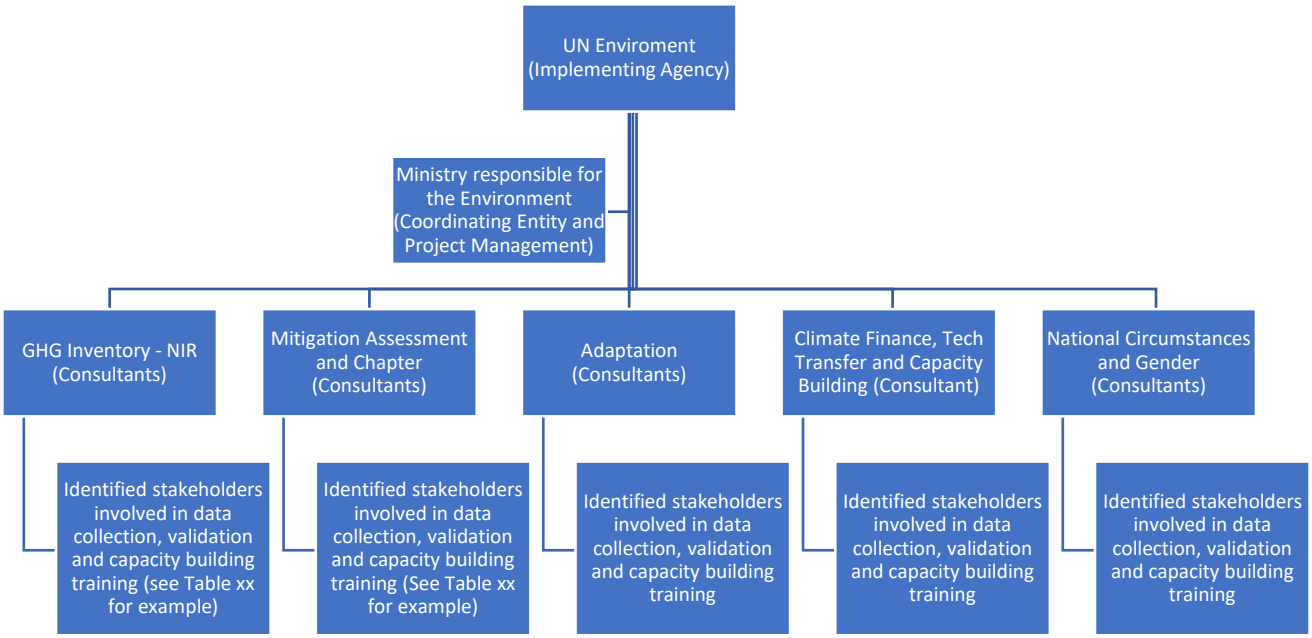


Table 2.1- Institutions and roles of stakeholders involved in the preparation of St. Kitts and Nevis NIR and Mitigation Assessment

MRV Component	Sector	Responsible Entity	Role
Planning	Crosscutting	● Ministry of Environment and Cooperatives	Coordinating and policymaking authority with respect to environment and climate change in St. Kitts and Nevis. Overseeing the entire national inventory process from the early stages of data collection through processing and reporting. This includes liaising with data providers, and identifying national sectoral experts, as well as coordinating their capacity building.
Data-Collection	Energy	● Ministry with responsibility for the Environment ● Department of Statistics ● Nevis Electricity Company (NEVLEC) ● Royal Utilities Marriot Frigate Bay ● St. Kitts Electricity Company Limited (SKELEC) ● Sol Petroleum Group ● Delta Petroleum ● PetroCaribe ● Custom and Excise Department ● Ministry with responsibility for Energy	Provides information related to GHG emissions associated with electricity generation, national fuel consumption data, energy balance, and vehicle registration data. Provides information on projects and future plans for the sector to inform potential mitigation actions.

	Agriculture	• Ministry of Environment and Cooperatives • Ministry of Agriculture, Fisheries and Marine Resources • Department of Statistics • Food and Agriculture Organisation (FAO)-Reports • Department of Statistics	Provides data and technical support when compiling GHG emissions for agriculture. Provides information on projects and future plans for the sector to inform potential mitigation actions.
	Forestry	• Ministry of Environment and Cooperatives • Forestry Unit • Lands and Survey Department • Forest and Agriculture Organization (FAO) (reports)	Provides technical support when compiling GHG emissions for land. Provides maps for the land sector. Provides information on projects and future plans for the sector to inform potential mitigation actions.
	Waste	• Solid Waste Management Cooperation (SWMC) • Department of Statistics • Carib Brewery • World Bank and UN Statistics (reports)	Provides information on the waste sector. Provides statistical parameters that can be applied when estimating GHG emissions from the waste sector. Provides information on the country's wastewater treatment works (domestic and industrial). Provides information on projects and future plans for the sector to inform potential mitigation actions
	Industrial Processes	• Custom and Excise Department • Department of Statistics	Provides GHG information for the IPPU sector, particularly on refrigerants.

	and Pro duct Use	• Ozone Unit	Provides information on projects and future plans for the sector to inform potential mitigation actions.
Preparation	Sectors and Cross cutting	• Caribbean Cooperative MRV Hub and Greenhouse Gas Management Institute • Support of National Experts and Data Providers	Provides capacity to chosen national sectoral experts to take a hands-on role in preparation of National Greenhouse Gas Inventory. Provides capacity training to mitigation team in the development of the models and assessment for mitigation. Collecting and evaluating data. Selection of methodological approaches and use of expert judgement. Estimation of GHG emissions. Assessment of uncertainty and analysis of key categories. Preparation of inventory report.

Quality Control	Cross cutting	• External MRV Hub and GHGMI experts	Review of estimations and expert judgement by experts not involved in the compilation of greenhouse gases. Review of data and projections and expert judgement by mitigation team not involved in the modelling process.
Quality Assurance/ Review	All Sectors	• Sectoral experts, and data providers including: • Ministry of the Environment and Cooperatives • Department of Statistics • Nevis Electricity Company Ltd • Royal Utilities Marriot Frigate Bay • St. Kitts Electricity Company Limited • Sol Petroleum Group • Delta Petroleum • PetroCaribe • Custom and Excise Department • Ministry of Environment and Cooperatives • Ministry of Agriculture, Fisheries and Marine Resources • Department of Statistics • Forestry Unit • Lands and Survey Department • Solid Waste Management Cooperation (SWMC) • Department of Statistics • Carib Brewery • Ozone Unit	Review National Circumstances of methods, approaches, and assumptions. Formal and informal technical reviews of National Inventory Report. Validation workshop for mitigation actions and modelling with stakeholders.

		• St. Kitts and Nevis Bureau of Standards St. Kitts and Nevis Met Office	
Validate	Sectors and Cross cutting	• Identified St. Kitts and Nevis sectoral experts and relevant Government officials as identified in the Institutional Arrangements • Cabinet	Provide oversight on the compilation of the report, including reviewing and providing inputs on activity data, emission factors, relevant input parameters and expert judgement used, in order to ensure the reports and GHGI emission estimates reflect national circumstances. Validates the final NIR before submission to the Cabinet. Provides final approval of NIR, BURs, etc. before submission to the UNFCCC.
Management	Cross cutting	• Department of Environment, Ministry of Environment and Cooperatives	Data collection procedures, documentation, data archiving, reviewing, checking and evaluation of planned prioritised improvements, data collected and summarised data gaps list. Submission of final report to the UNFCCC. Review of necessary inventory improvements and data archiving procedures.

2.3 Overall coordination of MRV

The government structures relevant to climate MRV are led by the Department of the Environment (DOE) in the Ministry of Sustainable Development, Climate Action, Environment and Constituency Empowerment. The DOE has the role and responsibility of overseeing the implementation of procurement and deliverables produced from national, regional, and international project-based consultants. The DOE ultimately provides final validation and approval, prior to the submission of reports to the UNFCCC.

Though not fully implemented, the Government of St. Kitts and Nevis has drafted Terms of Reference for the establishment of a National Climate Change Committee (NCCC) with the intended purpose of steering the national implementation of the National Climate Change Policy (2017) as well as other climate change related projects. The NCCC is intended to be a multi-disciplinary and multisectoral body with representative stakeholders selected from private and civil agencies as well as government entities.

Regionally, St. Kitts and Nevis has worked with other CARICOM countries on climate MRV elements vis-a-vis an executed Memorandum of Understanding (MoU) with the Caribbean Cooperative MRV Hub (2019-2023), and through regional Green Climate Fund (GCF) projects such as capacity building to facilitate climate resilience in disaster risk management and private sector access to climate finance (2021) as well as capacity building to support planning, programming and implementation of GCF funded activities (2020).

St. Kitts and Nevis has successfully engaged local and regional partners, namely the MRV Hub (GHGI, Mitigation, MRV and FTC) and Relate Consultancy (Gender/Vulnerability).

2.3.1 Legal arrangements for domestic MRV

St. Kitts and Nevis ratified the Paris Agreement under the UNFCCC on 22nd April 2016 and thus has the responsibility of meeting the climate change reporting requirements of the Paris Agreement, including the Enhanced Transparency Framework (ETF). At present, St. Kitts and Nevis currently lacks a comprehensive, detailed, and unambiguous legal framework for national climate MRV. However, there does exist a legal context that has relevance to components of Climate MRV.

St. Kitts and Nevis has several pieces of legislation that address environmental protection, natural resource management and data collection that serve as a baseline for integration into a future legal framework for climate change reporting and activities. A list of existing laws and policy frameworks for elements of integration are listed below:

- National Conservation and Environmental Protection Act (2009)
- The Fisheries Act
- Agricultural Development Act
- Development Control and Planning Act
- National Energy Policy and Energy Action Plan (2011)
- Integrated Resource Plan (2017)

- National Climate Change Policy (2017)
- National Climate Change Adaptation Strategy (2018)
- Solid Waste Management Act (2009)
- Caricom Regional Energy Efficiency Building Code (Adopted 2019)

2.3.2 Informal arrangements for domestic MRV

St. Kitts and Nevis has numerous departmental strategy and planning documents that are inclusive of climate MRV components. These strategy and planning documents serve as guiding documents, however, and are not necessarily indicative of formalised MRV roles or responsibilities.

2.3.3 Stakeholders involved in MRV

St. Kitts and Nevis has a strong set of stakeholders involved in climate MRV. Specific roles and responsibilities for each stakeholder have not yet been established. Many of the stakeholders listed in **Table 1** carry out MRV activities across multiple climate pillars and/or multiple MRV components. It should be noted that even if not specifically indicated in Table 2, the St. Kitts and Nevis government operates using mirror ministries for both islands.

Table 1.2 MRV system stakeholder list, roughly allocated across the three climate pillars

Primary climate pillar within MRV system *Agencies may serve in multiple areas and/or sector expertise.*	Agency or Institution	Sector/Expertise
Institutional Coordination & Leadership	**Department of Environment (DOE)**	Institutional
	Ministry of Sustainable Development, Climate Action, Environment and Constituency Empowerment	Institutional
Mitigation & GHG Inventory	**Department of Environment (DOE)**	Agriculture
	Ministry of Agriculture, Fisheries and Marine Resources	Agriculture
	Department of Statistics	Agriculture
	Food and Agriculture Organisation (FAO)	Agriculture
	Forestry Unit	FOLU
	Lands and Surveys Department	FOLU

	Ministry of Public Infrastructure and Utilities, Transport, Information, Communication and Technology and Post	Energy
	Ministry of Tourism, Civil Aviation and Urban Development	Energy
	Department of Statistics	Energy
	Nevis Electricity Company (NEVLEC)	Energy
	Royal Utilities Marriot Frigate Bay	Energy
	St. Kitts Electricity Company Limited (SKELEC)	Energy
	Sol Petroleum Group	Energy
	Delta Petroleum	Energy
	Petro Caribe	Energy
	Customs and Excise Department	Energy
	St. Christopher Air and Seaport Authority	Energy
	Solid Waste Management Corporation	Waste
	Department of Statistics	Waste
	Carib Brewery	Waste
Adaptation	**Department of the Environment**	Adaptation and Resilience
	Department of Economic Affairs and PSIP	Adaptation and Resilience
	Ministry of Tourism, Civil Aviation and Urban Development	Adaptation and Resilience
	Ministry of Sustainable Development, Climate Action, Environment and Constituency Empowerment	Adaptation and Resilience
	St. Kitts and Nevis Bureau of Standards	Data and Information
	St. Kitts and Nevis Chamber of Industry and Commerce	Data and Information
	Department of Physical Planning	Adaptation and Resilience
	IWRM Nevis	Water & Coastal Zone Resources

	Ministry of Finance, National Security, Citizenship and Immigration, Health, and Social Security	Adaptation and Resilience
	Department of Marine Resources and Nevis Turtle Group	Data and Information/ Adaptation and Resilience
	Department of Agriculture	Data and Information
Is something missing from here?	**Water Resources - Nevis**	Adaptation and Resilience
	Nevis Disaster Management	Adaptation and Resilience
	St. Kitts and Nevis Met Service	Data and Information
Support	**Ministry of Finance, National Security, Citizenship and Immigration, Health, and Social Security**	Finance & Economic Development
	Ministry of Sustainable Development, Climate Action, Environment and Constituency Empowerment	Finance & Economic Development/ Capacity Building
	Ministry of Foreign Affairs, Economic Development, International Trade, Information, Communication and Technology and Post	Finance & Economic Development
Crosscutting	**Ministry of Education, Youth, Social Development and Gender Affairs**	Education
	Ministry of Finance, National Security, Citizenship and Immigration, Health, and Social Security	Finance & Economic Development
	St. Kitts and Nevis Customs and Excise Division	Data and Information
	Department of Statistics	Data and Information
	St. Kitts and Nevis Chamber of Industry and Commerce	Finance & Economic Development
	Ministry of Justice and Legal Affairs	Legal Affairs

2.4 GHG inventory, mitigation, adaptation, and support MRV

St. Kitts and Nevis is working towards further developing MRV system components that move from a project-based (linear) system to an on-going, recurring system (cyclical). Until further development is completed, typical information management systems and cross-coordination of MRV work within each climate change pillar (mitigation, adaptation, support) will be limited. Identified MRV needs highlighted in Table 3 will support the further elaboration of explicit roles and responsibilities, information collection and management, quality assurance and quality control (QA/QC) procedures, continuous standard operating procedures, documentation and archiving of data, and preparation and improvement planning documents.

2.4.1 Data collection and management

In general, data collection agreements and enforcement are not standard amongst broader climate MRV stakeholders in St. Kitts and Nevis. However, there are isolated data collection mandates in the FOLU, agriculture, energy, and transportation sectors. In general, data collection and reporting are directly linked to Ministry objectives or project-based reporting cycles.

The primary data used in the most recent climate reporting, namely the GHG inventory, mitigation assessment, and vulnerability assessment, was accomplished through ad-hoc requests from identified stakeholders relevant to the reporting sector who may collect data sets through operation of agency-specific projects, research, or other mandates. These sources combined constitute a solid foundation of data suppliers. The Department of Statistics conducts labour and census surveys. These surveys are on a typical schedule, but challenges have been noted in recent years due to lack of timeliness of implementation and lack of resources.
Disaggregated datasets by standardised social, environmental, or economic indicators or parameters (example, sex-disaggregated climate data) are limited but have improved in recent years due to stakeholder participation and international conventions (e.g., climate change, biodiversity, and sustainable development goals).

2.4.2 Climate action development and implementation

Similar to data collection and management, mitigation and adaptation actions are developed and implemented by a range of stakeholders and government ministries. Measurement of actions from preparation, implementation, to on-going monitoring phases (inclusive of the choice of progress indicators). Currently, project-based measurement, reporting, and verification of mitigation and adaptation actions are implemented when climate finance is available and/or at the direction of climate action funding sources.

2.4.3 National Climate Change Committee (NCCC) - Purpose and Function

The Government of St. Kitts and Nevis intends to establish and implement the procedural action tasks defined in its draft Terms of Reference for the NCCC before the Parties' next reporting cycle. The NCCC will act as an oversight body responsible for facilitating he implementation of St. Kitts and Nevis National Climate Change Policy and climate change related projects (inclusive of international reporting obligations). It is envisaged that through the implementation of its mapped-out functions, the process of climate change reporting and its related MRV components will become more informed, transparent, and streamlined. Identified functions include (as identified in draft ToR for NCCC):

- Develop and implement the incorporation of climate change considerations into national development planning across all sectors
- Develop and implement a public relations and awareness strategy
- Provide guidance on the selection and development of climate change related projects for submission to international funding agencies
- Advise on any other matters related to climate change and its impacts on St. Kitts and Nevis
- Be the focal points for climate change in their respective organisations and/or sectors
- Act as the main advisory body to the Government of St. Kitts and Nevis on any matters related to climate change
- Guide the development and implementation of national adaptation and mitigation plans for St. Kitts and Nevis
- Advise on the incorporation of climate change considerations into relevant national development plans, budgets as well as sector plans ("Climate-proofing") and monitor implementation
- Monitor and provide guidance for the implementation of climate change projects and programmes in St. Kitts and Nevis to ensure coherence and effectiveness
- Consult on a regular basis with civil society, the private sector, academia, and relevant Ministries membership

Two working groups are planned under the climate change pillars of adaptation and mitigation to facilitate the implementation of the functions of the NCCC identified above. Table 3 below, identifies the various sectoral stakeholders that are envisaged to form the mitigation and adaptation working groups.

Table 2.3- Potential Stakeholder List for Mitigation and Adaptation Working Groups

Mitigation Working Group	Adaptation Working Group
Energy Unit	Department of Physical Planning
SKELEC	Department responsible for Water Resources
NEVLEC	Department of Agriculture
Ministry responsible for Transport	Marine Resources
Forestry Division	Disaster Preparedness Representative

Department of Agriculture	Ministry responsible for Health
Solid Waste	Met Services
Economic Affairs	Department of the Environment
Department of the Environment	Gender Representative
Met Services	Youth Representative
Gender Representative	Farmer Representative
Youth Representative	Civil Society Representative
Private Sector Representative	NHCS
Ministry responsible for Finance	National Trust
	Public Works and Infrastructure
	Ministry responsible for Finance

2.4.4 Support and climate finance MRV

The Government of St. Kitts and Nevis has not developed a climate finance MRV methodology (example, use of OECD Rio Markers) or a tool for tracking climate support needed and received to integrate within the broader envisaged National MRV System. A feasibility study is planned to develop the tool and its required data inputs to facilitate reporting of support needed and received for the Parties' UNFCCC reporting cycles.
The tool will allow St. Kitts and Nevis to:

- Have a clear overview of Nationally Determined Contribution (NDC) related financial flows, sources, and purposes
- Have a clear overview of climate change projects related financial flows, sources, and purposes
- Indicate the recipients of capacity building and technology transfer support inclusive of financial flows, sources, and purposes
- Indicate the recipients of financial support and identify gaps in sectoral support
- Demonstrate accountability, transparency, and trust in future UNFCCC's negotiations
- The costs to implement the adaptation and mitigation actions that are outlined in the NDC
- The cost to implement adaptation and mitigation actions not included in its NDC
- The investments and finance needed to achieve St. Kitts and Nevis adaptation and mitigation priorities as outlined in its NDC

2.5 Current progress towards establishment of a domestic MRV system

The Government of St. Kitts and Nevis through the TNC/BUR1 project prioritised the need to sensitise local stakeholders through capacity building activities in the fields of climate change MRV in an effort to move from a decentralised project based on system and improve overall

transparency in its reporting outputs. Activities included two training workshops to validate proposed institutional arrangements MRV framework through conducting a detailed mapping survey as well as sensitisation on the following topics below. All stakeholders involved in capacity building training under the climate pillars of mitigation and adaptation as well as those involved in coordination of climate change related activities in St. Kitts and Nevis were invited to attend. Workshop topics covered:

- Reporting under the climate pillars of mitigation and adaptation
- Functional components of MRV systems
- Institutional arrangements and mapping of roles/responsibilities
- Initial institutional arrangement mapping based on stakeholder surveys collected and analysed
- Transition to the Enhanced Transparency Framework (ETF)
- Biennial Transparency Reporting outline and Common Reporting Tables (CRT)
- Sensitisation to common tabular format (CTF) reporting – tracking NDC implementation and progress

Initial analysis of information gathered during the SKN baseline MRV assessment identified the need to implement the proposed National MRV system (inclusive of the NCCC) as current decisions under the Paris Agreement require the documentation of institutional arrangement mapping of all reported sectors as well as increased scrutiny on the adherence to the TACCC principles of SKN international reporting outputs. To establish an implementation baseline, the following prioritised gaps and potential improvements were identified (see Table 4)

Table 2.4 Gaps and needs of improvement identified for St. Kitts and Nevis MRV system

Identified Gaps	Needs for Improvement
MRV system not yet formally established.	Set up MRV system with explicit roles/responsibilities mapped for all envisaged stakeholders in the aforementioned system. Priority and focus to be placed on: • Ensuring that administrative capacity is sufficient for identified tasks. • Capacity building training provided to activity data providers involved in multiple reporting sectors due to the current lack of technical/human capacity in country.
Data collection, processing and reporting efforts need to yield better data more efficiently.	Establish and implement a sustainable MRV system with appropriate institutional, procedural, and legal arrangements with

	clear reporting and documentation requirements.
No official legislative or compliance mechanisms.	Conduct analysis of current legislation and policies and used recommendations to revise and/or draft legislation/policies that mandate the execution and continuation of climate change related activities as well as data collection efforts that are internationally binding (example, UNFCCC reports under the Paris Agreement).
No established data sharing agreements amongst stakeholders.	Implement standardised operating procedures and agreements for data sharing to regularly collect data and reporting across all economic sectors that adhere to the timelines proposed in the GHG reporting cycle. St. Kitts and Nevis as a starting point, needs to implement memoranda of understanding and confidentiality agreements to facilitate the process in the interim.
Need for greater public awareness around climate change initiatives.	Conduct education and awareness campaigns from primary education level to broader public awareness campaigns. Public buy-in will foster political buy-in, which will be necessary for government stakeholders to continue their commitment to climate MRV.
Lack of institutional and human capacity to operate envisaged MRV system.	Increase in number of staff hires to meet the demands of new national commitments for enhancing national climate MRV systems, enhanced international reporting requirements (Enhanced Transparency Framework) and other related permanent functions such as participation in National GHG Inventory preparation, tracking of NDC actions (implementation and progress), gender experts, and climate support tracking (climate finance, technology transfer and capacity building).
No established MRV QA/QC procedures.	Embed QC procedures throughout the MRV system and enact a set of QA procedures to

	assess the accuracy of final reports. Quality control procedures to be implemented at the data collection, calculation, and compilation phase with a QA/QC coordinator identified at the start of the next reporting cycle.
No established MRV data archiving procedures.	Embed data archiving procedures throughout the MRV system to ensure no loss of instituionalised or historical data for future Party reporting cycles. Selection of a data archiving coordinator before the start of the next reporting cycle is recommended.
Lack of formal performance indicators to monitor mitigation and adaptation actions.	Develop and track set of national MRV performance indicators to monitor the implementation and progress of mitigation and adaptation actions. Capacity building on the choice of progress indicators as well as sensitisation on use of the common tabular format reporting template is recommended.
Insufficient domestic allocation for funding MRV system.	Increase domestic allocation of funding to implement climate goals and monitor execution in the medium to long term where feasible and based on prioritisation of national resources.

As St. Kitts and Nevis moves towards a centralised project-based system and eventually a centralised on-going system, the following list of prioritised activities have been included in its MRV system improvement plan:

- Drafting of legal mandate and/or policy defining data to be collected. Required data sources and data collection procedures to be identified in document.
- Mapping of formalised institutional arrangements
- Documentation of domestic resource allocations for climate related agenda (financial and human)
- Inclusion and implementation of the use of data collection templates designed and presented during TNC/BUR1 action tasks
- Implementation of quality assurance/quality control procedural elements and action tasks inclusive of checklists and National QA/QC plan
- Design and implementation of a data management system inclusive of section dedicated to data archiving and institutionalisation of memory
- Integration of country specific planning and/or preparation documents to ensure conducted activities are in line with government priorities.
- Sensitisation on the use of the Common Reporting Tables and Common Tabular Formats that are required for reporting under the Enhanced Transparency Framework.

- Increased stakeholder engagement for continued buy-in to the process as current envisaged action tasks under the proposed MRV system fall outside the current mapped job responsibilities of stakeholders.
- Documentation of current methodologies applied for estimations to ensure no loss of historical memory.
- Setting up a proposed ministerial climate change committee to ensure consistency amongst ministries in the government and across national plans, to ensure high level political support from the government and to promote cross-sectoral coordination amongst all envisaged stakeholders.

  The Ministerial Climate Change Committee should include all current ministries due to the cross sectoral nature of climate change reporting and are identified as follows:

  (1) Ministry of Finance, National Security, Citizenship and Immigration, Health and Social Security
  (2) Ministry of Education, Youth, Social Development and Gender Affairs
  (3) Ministry of Foreign Affairs, Economic Development, International Trade, Investment, Industry and Commerce
  (4) Ministry of Public Infrastructure and Utilities, Transport, Information, Communication and Technology and Post
  (5) Ministry of Agriculture, Fisheries, Marine Resources, Entrepreneurship, Cooperatives and Creative Economy
  (6) Ministry of Tourism, Civil Aviation and Urban Development
  (7) Ministry of Justice and Legal Affairs
  (8) Ministry of Sustainable Development, Climate Action, Environment and Constituency Empowerment

Furthermore, domestically, it is expected that this proposed MRV system will allow for the Government of St. Kitts and Nevis to:

- Demonstrate transparency, accountability, and trust to the taxpayers of St. Kitts and Nevis
- Determine the impacts and costs of climate change actions
- Determine the investments needed to achieve adaptation and mitigation priorities highlighted in the St. Kitts and Nevis Nationally Determined Contributions
- Track progress of climate policies to improve implementation and ensure climate priorities and outcomes are achieved.

Chapter 3. National Greenhouse Gas Inventory

St. Kitts and Nevis GHG emissions estimates were prepared in line with 2006 IPCC guidelines. The IPCC guidelines for the implementation of the GHG inventory contain prescribed methods for the calculation of emissions, providing a unified framework for the reporting and documenting of all sources for all inventories. One of the main aims of this method is to ensure comparability of data gathered in individual states and that calls for a definition of at least a minimum scope of equal methods, criteria, and estimating procedures.

The conceptual approach towards the preparation of the GHG inventory for St. Kitts and Nevis allows for reporting of the results both using 2006 IPCC reporting tables or CRF reporting tables as used by Annex I countries, adjusted for the reporting elements which are not applicable for the non-Annex I countries. Such an approach will allow St. Kitts and Nevis a smoother transition to any reporting format required under the Paris agreement. Furthermore, increased transparency achieved through enhanced reporting information allows for the international review process to identify potential issues, recommendations, and encouragements for further improvement of the St. Kitts and Nevis GHG inventory estimates.

General Introduction

Scope

The Scope of the GHG inventory represents the geographical coverage of the territory of St. Kitts and Nevis as internationally recognised.

Global Warming Potential

The global warming potential (GWP) of a greenhouse gas is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kg of a trace substance relative to that of 1 kg of a reference gas. Direct radiative effects occur when the gas itself is a greenhouse gas. The reference gas used is CO_2 and therefore GWP-weighted emissions are measured in Gg of CO_2 equivalents (Gg CO_2 eq.).

Table 3-1, below, lists the direct (except for CH_4) 100-year time horizon of GWPs relative to CO_2 for all GHGs included in the inventory of St. Kitts and Nevis. This table is adapted from Table 8.A.1 of the Appendix 8.A of the IPCC Fifth Assessment Report (5AR) which includes most recent GWP values.

Table 3-1. Global Warming Potentials (100 Yr Time Horizon) from the IPCC Fifth Assessment Report.

Gas – common name	Chemical formula	GWP from 5AR
Carbon dioxide	CO_2	1
Methane*	CH_4	28
Nitrous oxide	N_2O	265
HFC-32	CH_2F_2	677
HFC-125	CHF_2CF_3	3,170
HFC-134a	CH_2FCF_3	1,300
HFC-143a	CH_3CF_3	4,800
HFC-227ea	CF_3CHFCF_3	2,640
PFC14	CF_4	6,630
PFC116	C_2F_6	11,100
Sulphur hexafluoride	SF_6	23,500

Global warming potentials are not provided for CO, NO_x, NMVOCs, SO_2 or aerosols because there is no agreed method to estimate the contribution of gases that are short-lived in the atmosphere, spatially variable, and have only indirect effects on radiative forcing.

3.1 Inventory preparation

The process of inventory preparation is designed according to the PDCA-cycle (Plan-Do-Check-Act). This is a generally accepted model for pursuing systematic quality work according to international standards, in order to ensure the maintenance and development of quality systems. This structure is in accordance with structures described in decision 19/CMP.1 and in the 2006 IPCC guidelines. The process consists of inventory planning, inventory preparation, inventory quality checking and prioritised improvements based on national circumstance which are integrated into the annual GHG inventory cycle.

All inventory data is stored in a structured folder and filing system made available on a cloud drive to the St. Kitts Ministry of Environment and Cooperatives. Supporting data and references are stored and archived in electronic form and on various media (CD-ROM, hard copies). Access to files is limited in accordance with the security and confidentiality policy. Backup copies of the Dropbox folder are made on individual computers, MRV Hub folders are also backed-up and archived at regular intervals in accordance with the requirements of the information system.

Before the inventory is reported to the UNFCCC Secretariat, GHG emission estimates and the relevant chapter goes through an approval process. The institution designated for final approval is the Ministry of Environment and Cooperatives with inventory estimates sent to all other relevant ministries and departments for comments and consent.

Once the planned MRV system becomes fully functional in St. Kitts and Nevis, the Party intends to make its GHG inventories publicly available on their website. Every submission is expected to be accompanied by a short description of the GHG emission trends. The GHG emission estimates will be presented in a more aggregated manner in order to better communicate the climate change related issues to the general public. GHG emissions will also be presented through indicators such as carbon intensity of the economy and carbon emissions per capita.

Table 3-1. Key Data Sources used in GHGI Reporting Cycle

Source	Activity data/Fuels	Years covered	Scope	Reference
Department of Customs	motor gasoline, aviation gasoline, kerosene, gas oil, diesel, lubricants and others	2008-2018-	Total national consumption of each fuel	Department of customs database

Source	Activity data/Fuels	Years covered	Scope	Reference
Department of Tourism, Transport and ports	Number of registered road vehicles in St. Kits and Nevis	2020	Vehicle fleet in St. Kitts and Nevis	Vehicle fleet database 2020 Nevis Statistical Digest 2019
Energy Balance	firewood, LPG, gasoline alcohol, jet fuel, kerosene, diesel oil, fuel oil, charcoal, non-energy	2010-2012	Total national consumption of each fuel	OLADE (Latin American Energy Organisation) (2015); The Bahamas. Energy Balances 2010-2012; file http://biblioteca.olade.org/opac-tmpl/Documentos/old0349.pdf.
Nevis electric Company	gas/diesel oil	2011-2018	Consumption of fuels for power generation in Nevis	Individual reporting to GHG inventory team
Royal Utilities Marriot Frigate Bay	gas/diesel oil	2011-2018	Consumption of fuels for power generation in the St. Kitts	Individual reporting to GHG inventory team
St. Kitts Electricity Company Limited	gas/diesel oil	2008-2018	Consumption of fuels for power generation in the St. Kitts	Individual reporting to GHG inventory team
Sol Petroleum Group	gasoline, diesel, LPG	2013-2018	Fuels delivered for retail, government, commercial and power sector	Individual reporting to GHG inventory team
Delta Petroleum	high sulphur diesel, ultra-low sulphur diesel, LPG	2008-2018	Fuel delivered to the final consumers	Individual reporting to GHG inventory team
Petrocaribe	diesel, gasoline	2008-2018	Fuel delivered to the market and by different suppliers to different clients	Individual reporting to GHG inventory team
World bank	Historical GDP growth, total primary consumption, total electricity production,	2008-2018	Macroeconomic and social drivers	https://ourworldindata.org/energy/country/sai

Source	Activity data/Fuels	Years covered	Scope	Reference
	population growth (rural/urban), revenues from tourism, tourist visits			nt-kitts-and-nevis?country=~KNA https://data.worldbank.org/indicator/SP.POP.TOTL?locations=KN
Department of Statistics	Census data	1970, 1980, 1991, 2001, 2011	National water supply, toilet facilities and garbage disposal for St. Kitts and Nevis population.	Individual reporting to GHG inventory team
Department of Statistics	Population statistics	1871-2011 (10-year intervals)	Population growth and rates	Individual reporting to GHG inventory team
St. Kitts Solid Waste Management Corporation	Annual waste generation	2008-2018	Collected tonnage of waste at landfills in both St. Kitts and Nevis	Individual reporting to GHG Inventory team
World Bank	Population statistics	1960-2018	Annual population values for the years 1960-2018	https://data.worldbank.org/indicator/SP.POP.TOTL?locations=KN&year_high_desc=true
Carib Brewery	Wastewater (beer and malt)	2009-2018	Wastewater generated by local brewery	Individual reporting to GHG Inventory Team
St. Kitts and Nevis (Department of Statistics and Ministry of Agriculture, Fisheries and Marine Resources)	Livestock	2014-2018	Annual livestock count for St. Kitts and Nevis	Individual reporting to GHG Inventory Team

Source	Activity data/Fuels	Years covered	Scope	Reference
Ministry of Agriculture, Fisheries and Marine Resources	Manure management system	2000-2018	Manure management system allocation per livestock category	Individual reporting to GHG Inventory Team
Ministry of Agriculture, Fisheries and Marine Resources (Sales- TDC)	Urea purchases	2015, 2017 and 2018	Annual sales values from local distribution company	Individual reporting to GHG Inventory Team
FAOSTAT	Livestock	2000-2018	Annual livestock count for St. Kitts and Nevis	https://www.fao.org/faostat/en/%3f%23data#country/188 (individual dataset archived)
FAOSTAT	Urea	2002-2017	Total import urea values in tonnes	https://www.fao.org/faostat/en/%3f%23data#country/188 (individual dataset archived)
FAOSTAT	Fertiliser imports	2000-2018	Total import fertiliser values in tonnes for St. Kitts and Nevis	https://www.fao.org/faostat/en/%3f%23data#country/188 (individual dataset archived)
GIS Department, St. Kitts	GIS Land Cover Map 2017 - St. Kitts only	2017	Land cover map for St. Kitts generated from high resolution satellite imagery (~1m)	SKN GHGI: AFALU Methodology Report. Chezon Tuckett, Ronell Browne, 10/9/2020
ArcGIS Living Atlas	ESRI 2020 Land Cover Map - St. Kitts and Nevis	2020	A 10-meter resolution map of Earth's land surface from 2020	https://livingatlas.arcgis.com/landcover/
USGS	Recalibrated surface reflectance images from Landsat 7 and 8	2000 - 2020	Landsat satellite images covering both St. Kitts and Nevis	https://www.usgs.gov/landsat-missions/landsat-surface-reflectance
Google Earth Engine	High resolution satellite image in the google earth engine	2020	Google Earth Engine high resolution maps for 2020 – 2021 covering both St. Kitts	https://code.earthengine.google.com/

Source	Activity data/Fuels	Years covered	Scope	Reference
			and Nevis was used for digital verification of classified land use maps	

3.2 Institutional Arrangements

The Ministry of Environment and Cooperatives, apart from its role as the UNFCCC focal point, coordinates the preparation and presentation of all national reports submitted in adherence with the reporting requirements to the UNFCCC. At present, the technical aspects of the planning and preparation of the National Greenhouse Gas Inventory Report are led by regional/international consultants in a collaborative fashion with selected national experts with an aim to build national capacity and institutionalise the GHGI reporting process. This includes GHG inventory compilation training and hands-on participation in data collection, GHG inventory calculation training (inclusive of chosen methodologies, activity data and emission factors) and quality assurance activities during the inventory compilation process.

The institutions and roles of these actors involved in the preparation of the St. Kitts and Nevis NIR are shown below in Figure 3-1 and Table 3-3.

Figure 3-1 Institutional arrangements for the national GHG inventory preparation- St. Kitts and Nevis

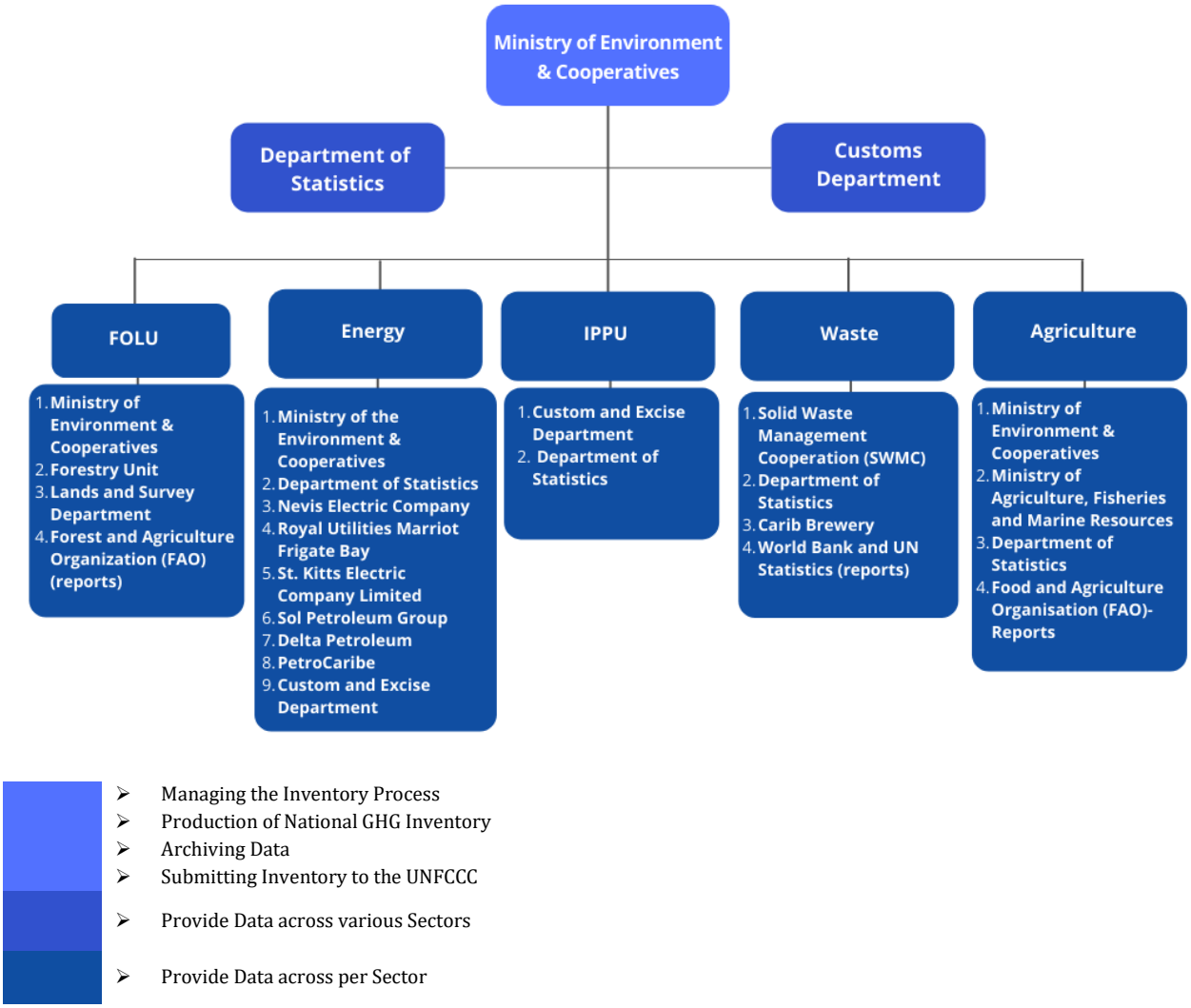


Table 3-2. Institutional Arrangements-Roles & Responsibilities

Inventory Phase	Sector	Institution and Contacts	Roles
Planning	Crosscutting	● Ministry of Environment and Cooperatives	● Coordinating and policymaking authority with respect to environment and climate change in the St. Kitts and Nevis. ● Overseeing the entire national inventory process from the early stages of data collection through processing and reporting. This includes liaising with data providers and identifying national sectoral experts and coordinating their capacity-building.
Data-Collection	Energy	● Ministry of the Environment and Cooperatives ● Department of Statistics ● Nevis Electric Company ● Royal Utilities Marriot Frigate Bay ● St. Kitts Electric Company Limited ● Sol Petroleum Group ● Delta Petroleum ● PetroCaribe ● Custom and Excise Department	Provides information on GHG emissions associated with electricity generation, national fuel consumption data, energy balance, and vehicle registration data.
	Agriculture	● Ministry of Environment and Cooperatives ● Ministry of Agriculture, Fisheries and Marine Resources ● Department of Statistics ● Food and Agriculture Organisation (FAO)-Reports	Provides data and technical support when compiling GHG emissions for agriculture.

Inventory Phase	Sector	Institution and Contacts	Roles
	Forestry	● Ministry of Environment and Cooperatives ● Forestry Unit ● Lands and Survey Department ● Forest and Agriculture Organization (FAO) (reports)	Provides technical support when compiling GHG emissions for land. Provides maps for the land sector.
	Waste	● Solid Waste Management Cooperation (SWMC) ● Department of Statistics ● Carib Brewery ● World Bank and UN Statistics (reports)	Provides information on the waste sector. Provides statistical parameters that can be applied when estimating GHG emissions from the waste sector. Provides information on the country's wastewater treatment works (domestic and industrial).
	Industrial Processes and Product Use	● Custom and Excise Department ● Department of Statistics	Provide GHG information for the IPPU sector, particularly on refrigerants.
Preparation	Sectors and Crosscutting	● Caribbean Cooperative MRV Hub and Greenhouse Gas Management Institute ● Support of National Experts and Data Providers	Provide Capacity to chosen National sectoral experts to take a hands-on role in preparation of National Greenhouse Gas Inventory. Collecting and evaluating data. Selection of methodological approaches and use of expert judgement. Estimation of GHG emissions.

Inventory Phase	Sector	Institution and Contacts	Roles
			Assessment of uncertainty and analysis of key categories. Preparation of inventory report.
Quality Control	Cross-cutting	• External MRV Hub and GHGMI experts	Review of estimations and expert judgement by experts not involved in the compilation of greenhouse gases.

Inventory Phase	Sector	Institution and Contacts	Roles
Quality Assurance/ Review	All Sectors	• Sectoral Experts, and Data Providers including: • Ministry of the Environment and Cooperatives • Department of Statistics • Nevis Electric Company • Royal Utilities Marriot Frigate Bay • St. Kitts Electric Company Limited • Sol Petroleum Group • Delta Petroleum • PetroCaribe • Custom and Excise Department • Ministry of Environment and Cooperatives • Ministry of Agriculture, Fisheries and Marine Resources • Department of Statistics • Forestry Unit • Lands and Survey Department • Solid Waste Management Cooperation (SWMC) • Department of Statistics • Carib Brewery	Review National Circumstances of methods, approaches, and assumptions. Formal and informal technical reviews of National Inventory Report.
Validate	Sectors and Cross-cutting	• Identified St. Kitts and Nevis sectoral experts and relevant Government officials as identified in the Institutional Arrangements • Cabinet	Provide oversight on the compilation of the report, including reviewing and providing inputs on activity data, emission factors, relevant input parameters and expert judgement used, in order to ensure the reports and GHGI emission estimates reflect national circumstances.

Inventory Phase	Sector	Institution and Contacts	Roles
			Validates the final NIR before submission to the Cabinet Provides final approval of NIR, BURs, etc. before submission to the UNFCCC.
Management	Cross-cutting	● Department of Environment, Ministry of Environment and Cooperatives	Data collection procedures, documentation, data archiving, reviewing, checking and evaluation of planned prioritised improvements, data collected and summarised data gaps list. Submission of final report to the UNFCCC. Review of necessary inventory improvements and data archiving procedures.

3.3 Brief General Description of Methodologies used and data sources

GHG emissions inventories were prepared in accordance with the IPCC methodology as presented in the 2006 IPCC Guidelines for all gases and sectors. Due to the importance of the source and accessibility of activity data, different approaches (tiers) from the IPCC methodology were used (**Error! Reference source not found.**).

Table 3-3. Summary Report for Methods and Emission Factors used from CRF Tables

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O	
	Method applied	EF	Method applied	EF	Method applied	EF
1. Energy	**T1**	**D**	**T1**	**D**	**T1**	**D**
A. Fuel combustion	T1	D	T1	D	T1	D

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O	
	Method applied	**EF**	**Method applied**	**EF**	**Method applied**	**EF**
1. Energy industries	T1	D	T1	D	T1	D
2. Manufacturing ind. and const.	T1	D	T1	D	T1	D
3. Transport	T1	D	T1	D	T1	D
4. Other sectors	T1	D	T1	D	T1	D
5. Other	NO	NA	NO	NA	NO	NA
B. Fugitive emissions from fuels	T1	D	T1	D	T1	D
1. Solid fuels	NO	NA	NO	NA	NO	NA
2. Oil and natural gas	T1	D	T1	D	T1	D
2. Industrial Processes	NO, NE	NA, NE	NO, NE	NA, NE	NO, NE	NA, NE
A. Mineral Products	NO	NO	NA	NA	NA	NA
B. Chemical Industry	NO	NO	NA	NA	NA	NA
C. Metal Production	NO	NO	NA	NA	NA	NA
D. Non-Energy Product	NO	NO				
F. Substitutes for ODS						
G. Other product man. and use	NE	NE	NE	NE	NE	NE
3. Agriculture	**T1**	**D**	**T1**	**D**	**T1**	**D**
A. Enteric Fermentation			T1	D		
B. Manure Management			T1	D	T1	D
D. Agricultural Soils			NA	NA	T1	D
G. Liming	NE	NE	NA	NA	NA	NA
H. Urea application	T1	D	NA	NA	NA	NA
4. LULUCF	**T1**	**D**	**T1**	**D**	**T1**	**D**
A. Forest Land	T1	D	T1	D	T1	D
B. Cropland	T1	D	NA	NA	T1	D
C. Grassland	T1	D	NA	NA	T1	D
D. Wetlands	T1	D	NA	NA	NA	NA
E. Settlements	T1	D	NA	NA	D	D
F. Other Land	T1	D	NA	NA	D	D
G. HWP	NE	NE	NA	NA	NA	NA
5. Waste	**T1**	**D**	**T1**	**CS, D**	**T1**	**D**
A. Solid Waste Disposal	NA	NA	T1	D		
B. Biological Treatment			T1	D	T1	D
C. Incineration	T1	D	T1	D	T1	D
D. Waste-water Treatment	NA	NA	T1	D	T1	D

	HFCs		PFCs		SF6	
	Method applied	**EF**	**Method applied**	**EF**	**Method applied**	**EF**
2. Industrial Processes	**NO, NE**	**NA, NE**	**NA, NO**	**NA**	**NA, NE**	**NA, NE**
C. Metal Production	NA	NA	NO	NA	NA	NA
F. Substitutes for ODS	NE	NE	NA	NA	NA	NA

G. Other product man. and use	NA	NA	NA	NA	NE	NE

3.3.1 ENERGY SECTOR

In the Energy sector, default IPCC emission factors and net calorific values (NCV's) were used for all types of commercial fuels.

The approach taken to determine quantities of fuels consumed was a combination of the bottom-up and the top-down approach, since consistent time-series for the national fuels consumption for the period 2008-2018 was not available. Bottom-up data at the national level was received from SOL Group, Delta Petroleum and PetroCaribe. These datasets were checked with top-down datasets received from St. Kitts and Nevis and after analysis were observed to have significant time-series consistency issues largely due to the customs department being migrated to a newer data management platform. Furthermore, there is an inconsistency in allocation of fuels between gas oil and diesel oil (also if combined). Various inconsistencies were observed for LPG, where bottom-up data show significantly higher estimates, however, the gasoline time-series was consistent and used in the assessment of the total primary energy supply for that fuel.

Energy industries

The quantities of fuel consumed for electricity production was determined through bottom-up questionnaires submitted to Nevis Electricity Company Limited, Royal Utilities - Marriot Frigate Bay, and to St. Kitts Electricity Company Limited. However, since the datasets were not complete (data for 2008-2010 was missing for some producers) the GHG emissions for 2008-2010 period were estimated through average efficiency of the electricity production at the producer's level, with missing data determined in the period 2011-2018 and the trend of overall electricity production in the period 2008-2010 as St. Kitts and Nevis reported to the World Bank.

Manufacturing industries and Construction

Fuels used in the manufacturing industry was determined using levels as determined by OLADE Energy Balance for St. Kitts and Nevis 2010-2012 and aligned with the overall trends of the St. Kitts and Nevis Primary Energy consumptions. Fuel used by construction was aligned with the evolution of trends for the number of heavy-duty vehicles and off-road machinery.

Transport sector

The quantities of gasoline consumed were taken from the customs database. Based on the vehicle fleet database for 2020 for St. Kitts and Nevis and historical evolution of the vehicle fleets licenced in Nevis (source: Nevis statistical digest); a bottom-up model for the fleet evolution for the period 2008-2018 and mileage driven for different types of road vehicles was developed and calibrated to the gasoline consumed in road transport. Once the model was calibrated to the gasoline consumption, the diesel consumptions for road transport was estimated using the same approach. Such an approach allows for better assumptions of N_2O and

CH_4 emissions from the Transport sector and will also allow for future improvements and estimation of emissions from lubricants used in the Transport sector.

Other (Commercial/Institutional sector and Households)

Emissions from households were estimated based on the consumption as identified in the OLADE Energy Balance for 2010-2012 scaled for the growth of the population in St. Kitts and Nevis, with exception of fuelwood and charcoal where consumption was scaled based on the growth of the rural population. In order to assess the top-down fuels available for both households and the commercial sector; the data was collected from individual producers/importers of charcoal for the period 2008-2018.

Fugitive emissions

Fugitive emissions in St. Kitts and Nevis follow the changes in the LPG transported in the period 2008-2018.

3.3.2 INDUSTRIAL PROCESSES AND PRODUCT USE

Emissions in the IPPU sector have not been estimated. The estimation of IPPU GHG emissions for subsequent GHG inventory preparation is addressed in the improvement plan.

3.3.3 AGRICULTURE SECTOR

After analysis of the available datasets, GHG emissions in the Agriculture sector were estimated by applying a Tier 1 IPCC approach and using default IPCC emission factors/inputs as highlighted in Table 1-2.

Enteric Fermentation

Livestock population datasets were provided by country experts for St. Kitts for the timeseries 2014-2019 with no available information for Nevis. After comparison with the data sourced from FAOSTAT for the timeseries 2008-2018, the latter was chosen as the input due to its longer timeseries and inclusion of Nevis estimates. Default IPCC emission factors were selected from Tables 10.10 and 10.11 (2006 IPCC Guidelines Vol 4) and are reflective of the LAC region.

Manure Management (CH_4)

As highlighted in the section above (enteric fermentation), FAOSTAT livestock values for the timeseries 2008-2018 were chosen by the GHGI compilation team. Default IPCC emission factors

were selected from Tables 10.14 – 10.16 (2006 IPCC Guidelines Vol 4) and are reflective of the LAC region.

Manure Management (Direct N_2O)

Data on Manure Management Systems (MMS) allocations was provided based on the identified species/livestock categories present in-country. MMS in St. Kitts and Nevis were inclusive of solid storage, dry lot, liquid slurry and pasture/range/paddock (included under managed soils). For livestock categories with two MMS allocations, a 50-50 split was assumed. FAOSTAT livestock values and IPCC defaults (Table 10.19 and 10A-4 to 10A-9- 2006 IPCC Guidelines Vol4) were selected for GHG emission estimates.

Manure Management (Indirect N_2O)

IPCC defaults for the following were chosen and applied to calculation methodologies:

- Fraction of managed livestock manure nitrogen that volatises (Table 10.22 Vol 4 2006 IPCC Guidelines);
- Emission factor for N_2O emissions from atmospheric deposition of nitrogen on soils and water surfaces (Table 11.3 Vol 4 2006 IPCC Guidelines);
- Amount of managed manure nitrogen for livestock category that is lost in the MMS (Table 10.23 Vol 4 2006 IPCC Guidelines);
- Emission factor for N_2O emissions from nitrogen-leaching/run-off.

Managed Soils (Direct and Indirect N_2O)

Livestock counts and annual amounts of nitrogen applied in synthetic fertilisers were sourced from FAOSTAT and used for GHG emission estimates in the managed soils sub-categories. IPCC default values for Typical Animal Mass, annual average nitrogen excretion per head of species, annual nitrogen excretion rate and emission factors for leaching and run-off/volatilization were selected as inputs as no country information was available. Defaults chosen were reflective of the LAC region.

Urea Fertilisation

The department of Agriculture provided the annual quantities of purchased urea for the timeseries 2015-2020 with 2016 data missing. Comparison to urea import data collected through FAOSTAT showed consistent values for the years 2015 and 2017, with the FAOSTAT

dataset applied due to access of data over a longer timeseries. The default IPCC emission factor was selected as no country information was available.

3.3.4 WASTE SECTOR

After analysis of the available datasets, GHG emissions in the Waste sector were estimated by applying a Tier 1 IPCC approach and using default IPCC emission factors/inputs as highlighted in Table 1-2.

Solid Waste Disposal

Country experts provided population growth and rates that were collected approximately every ten years through the national census process. Comparisons with annual population data accessed from the World Bank were consistent with the submitted country data (10-year intervals) and selected as the input for the First Order Decay (FOD) Model.

Information on annual waste generation was provided for the timeseries 2009-2018 and compared to the reflective IPCC defaults of the Caribbean region. Default value showed a difference of approximately 290kg/waste/capita/year lower than in-country data; with the latter chosen as the required input. IPCC default waste composition categorisations were used as country specific categorisations were not available in the relevant IPCC format (no Party categorisation definitions available for comparison). Sludge deposition values at MSW sites were obtained during the data collection process for the timeseries 2009-2018 and applied to the FOD model.

Due to the lack of collection/categorisation of information on industrial waste, St. Kitts and Nevis has included its Industrial estimates in its MSW GHG emission estimates. A Tier 1 approach using GDP per capita as the default input was applied and analysed by the Inventory team but was not deemed reflective of the Party as the GDP per capita values are heavily dependent on the Tourism Industry.

Open Burning

Population estimates and per capita waste generation were applied using the same dataset inputs gathered for Municipal Solid Waste. Due to no collected information for the fraction of population that open burns and after discussion with in-country experts, an allocation of 2% (fraction of population that open burns) was assumed and applied.

Domestic Wastewater

For calculating GHG emission estimates for domestic wastewater, St. Kitts and Nevis used the dataset from the World Bank as well as the IPCC default for BOD reflective of the LAC region. No

information was available on in-country BOD estimates. Information was provided on water supply and toilet facilities through the national census and was used to allocate the types of treatment or discharge. For the chosen treatment types (latrine, sewer, septic system, and sea/river/lake discharge), default values for MCF (specific to each treatment system) and Maximum Methane Producing Capacity (BOD) were used in the calculation of the applicable emission factor. Income group information in IPCC categorisations (rural, urban low-income, urban high-income) was not available. Urbanisation country estimates were sourced from the United Nations Population Division.

Industrial Wastewater

Wastewater generation values from the local brewery were provided for the timeseries 2009-2018 with default IPCC values for the MCF and B_0 used for the identified treatment or discharge.

3.4 Quality Assurance and Quality control

St. Kitts and Nevis is planning to develop and implement a new Quality Assurance and Quality Control (QA/QC) Plan as recommended by the IPCC Guidelines (IPCC 2006). This plan will identify the specific data quality objectives related to the principles of transparency, accuracy, consistency, completeness and comparability (TACCC) required for the St. Kitts and Nevis national inventory and provides specific guidance, documentation forms and templates for the practical implementation of QA/QC procedures. The QA/QC procedures cover such elements as data selection and acquisition, data processing and reporting. The QA/QC plan will be a part of the Manual of Procedures which is to provide a general overview of the QA/QC system. In addition, the manual provides guidance and templates for appropriate quality checking, documentation and transparency. The selection of source data, calculation methodologies, peer and expert review of inventory data and the annual requirements for continuous improvement of the inventory are also to be outlined in the manual.

Quality Control (QC) in St. Kitts and Nevis

Quality Control is a system of routine technical activities to measure and control the quality of the inventory as it is being developed. The QC system is designed to:

- Provide routine and consistent checks to ensure data integrity, correctness, and completeness;
- Identify and address errors and omissions;
- Document and archive inventory material and record all QC activities.

As the majority of calculations are performed using Excel spreadsheets, no human errors are expected once the system is validated. The Excel spreadsheets use specific colour codes in order to ensure that the data is manipulated only in the cells dedicated for the data input and not in the other cells. Once the validation process is finalised, the calculation cells will be locked for editing.

During development of the Excel spreadsheets, the following QC steps were performed:

Checks of methodological and data changes resulting in recalculations

- Check for temporal consistency in time series input data for each source category.
- Check for consistency in the algorithm/method used for calculations throughout the time series.

Completeness checks

- Confirm that estimates are reported for all source categories and for all years from the appropriate base year to the period of the current inventory.
- Check that known data gaps resulting in incomplete source category emissions estimates are documented.
- Compare estimates to previous estimates: for each source category, current inventory estimates should be compared to previous estimates. If there are significant changes or deviations from expected trends, recheck estimates and explain any differences.

Check of activity data, emission factors and other parameters

- Cross-check all input data from each source category for transcription errors.
- Check that units are properly labelled in calculation sheets.
- Check that units are correctly carried through from beginning to end in calculations.
- Check that conversion factors are correct.
- Check that temporal and spatial adjustment factors are used correctly.

Check of emissions estimates

- One of the elements of quality control of GHG emissions estimates is checking the general results through sets of regional indicators which allows for the assessment of the plausibility of the results in particular when emission estimates are based on assumptions and expert judgement. Furthermore, the plausibility checks on the evolution of trends are implemented in the LULUCF sector, where a specific focus is given to a land use and change matrix. While sudden and significant land use changes from one land use to other (such as from forestry land use) are possible due to the extreme weather (e.g., hurricanes) events or natural disasters (e.g., volcano eruptions), other changes are much less likely to happen over a short period of time (e.g., rapid land change to forest land, or from settlements to forestland). In such cases those land changes are carefully examined and if QC checks show that emissions happen due to errors in the data interpretation, such estimates are not included in the national totals. The identified issues are then included in the improvement plan and will be addressed in the subsequent submission. The priority level (low, medium, high, very high) is assessed in accordance with the used criteria (see Chapter 3.8)

Check of Uncertainty assessment

The checks consisted of the following:

- Check that the qualifications of individuals providing expert judgement for uncertainty estimates are appropriate.
- Check that qualifications, assumptions and expert judgements are recorded or referenced.
- Check that calculated uncertainties are complete and calculated correctly.
- Check that there is detailed internal documentation to support the uncertainty estimates.

While the first three QC checks were performed, the last QC check shows that detailed documentation is not available for most of the uncertainty estimates. The inventory compilation team with the guidance of local experts decided to use expert judgement except for categories for which default uncertainty estimates are available in 2006 IPCC GL.

Preparation of NIR

- Check if the Excel spreadsheet archive for NIR preparation has been created.
- Check that all the relevant chapters are included in the NIR.
- Check that AD, EF and other numerical information mentioned in the text is correct.
- Check all AD data is presented in the tables in the NIR.
- Check all EF and other parameters used in the tables in the NIR.

- Check all graphs for accuracy and presence in the whole period.
- Check all titles for tables and pictures.
- Check that all Annexes to the NIR are included and updated.

Documentation and archiving

QA/QC checks of documentation and archiving procedures:

- Check that inventory data, supporting data and inventory records are archived and stored to facilitate detailed review.
- Check that all supporting documentation is archived.
- Check that results of the QC analysis and uncertainty estimates are archived.
- Check that there is detailed internal documentation to support the estimates and enable replication of emissions estimates.
- Check that bibliographical data references are properly cited in the internal documentation and archived under the specific "References folder".
- Check that inventory improvements plan is updated and archived.

Quality assurance (QA) in St. Kitts and Nevis

QA generally consists of independent third-party review activities to ensure that the inventory represents the best possible estimates of emissions and removals and to support the effectiveness of the QC activities. It is planned that both local and MRV Hub experts coordinate peer reviews at regular intervals and carry out checks to verify the transparency, accuracy, consistency, comparability and completeness of submitted inventories. The review findings will then be addressed by the inventory team as appropriate and based on prioritisation of activities.

3.5 Uncertainty assessment

The combined uncertainty was derived using a Tier 1 method. The uncertainties of individual activity data and emission factors are based on expert judgment or IPCC 2006 Guidelines. Since expert judgments of individual experts are at variance, the highest individual uncertainties have been taken into account. The total uncertainties have been derived both for Level Uncertainty as well as for Trend Uncertainty.

Table 3-4. Uncertainty of GHG Emission Estimates in 2008 and 2018 by Sectors.

	2008	2018
1A Energy	6.90%	6.33%
2 Industrial Processes/Product use	NO	NO
3 Agriculture	50.06%	64.49%
4 LULUCF	56.07%	28.73%
5 Waste	87.37%	79.87%
TOTAL COMBINED UNCERTAINTY	**23.61%**	**24.14**
TOTAL COMBINED UNCERTAINTY (w/o	**13.71%**	**14.03%**

TOTAL trend uncertainty (2018/2008) = is 15.03% including LULUCF and 6.94% (w/o LULUCF).

The major factor that led to the lower uncertainty values in 2018 was contributed by the energy sector, mainly due to the improved AD compared to 2008 where some activity data was missing and therefore fall-back approaches to estimate emissions in 2008 were used. The higher uncertainty values in the agriculture sector are a result of a higher share of soil emissions where the same IPCC default EFs with large uncertainty have been used for the base year and for 2018 estimates.

More detailed data regarding the uncertainty assessment are included in the Appendix 2 to the NIR.

3.5.1 Uncertainty Assessment in LULUCF

Overall accuracy of classified land use maps increased from 56%-62% with Kappa value of 0.40 to 0.55 in Analysis 1 to 77%-90% and Kapp-values were between 0.72 and 0.88 in Analysis 2. In Analysis 2 axillary sugarcane field data, recalibrated Landsat surface reflectance images and NDVI band derived from the Landsat surface reflectance images were used to improve accuracy of classification.

Table 3-5. Improvement in Overall Accuracy of Land Use Classification

	Analysis 1		Analysis 2	
Year	Overall accuracy (%)	Kapp value	Overall accuracy (%)	Kapp value
2000	56.09	0.43	84.04	0.81
2005	56.00	0.44	86.50	0.83
2008	56.59	0.41	87.20	0.84
2011	56.21	0.40	76.75	0.72
2014	65.90	0.55	90.60	0.88
2018	62.12	0.55	80.40	0.76

3.6 Brief description of Key source categories

The analysis of key source categories was performed on the basis of sectoral distribution and use of Approach 1. This approach was used both for the year 2008 and for the year 2018. A level assessment was undertaken for 2008 and 2018, and a trend assessment was performed for 2018. The analysis has been performed at a level of IPCC categories as suggested in Table 4.1 in Volume 1 of 2006 IPCC Guidelines. The results are presented in **Error! Reference source not found.** and

below.

The analyses have been performed with and without LULUCF sector. On the basis of the KCA including LULUCF, 9 categories were selected as keys in 2018 according to the level assessment, and additional 2 were chosen as key categories according to the trend assessment only. As many as 8 categories are key sources according to level and trend KC analysis.

Table 3-6. IPCC Key Source Categories for 2018, Approach 1 – Level Only

IPCC Category code	IPCC Category		Greenhouse gas	Last Year emissions 2018 (ktCO2eq)	Lx,t	Cumulative Total of Column G
1.A.1	Energy Industries	Liquid fuels	CO_2	181.15	0.341	34.1%
3.B.1.b	Land Converted to Forest land	-	CO_2	98.70	0.186	52.7%
1.A.3.b	Road Transportation	-	CO_2	98.00	0.185	71.2%
4.A	Solid Waste Disposal	-	CH_4	45.90	0.086	79.8%
3.B.1.a	Forest land Remaining Forest land	-	CO_2	41.65	0.078	87.7%
3.B.3.b	Land Converted to Grassland	-	CO_2	13.73	0.026	90.3%
4.D	Wastewater Treatment and Discharge	-	CH_4	12.21	0.023	92.6%
3.B.2.b	Land Converted to Cropland	-	CO_2	10.33	0.019	94.5%
1.A.4	Other Sectors	Liquid fuels	CO_2	7.04	0.013	95.8%

Table 3-7. IPCC Key Source Categories for 2018, Approach 1 – Trend only

IPCC Category code	IPCC Category		Greenhouse gas	Base Year emissions 2008 (ktCO2eq)	Last Year emissions 2018 (ktCO2eq)	Base year Abs(Emission) kt CO2e	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Column G
1.A.3.b	Road Transportation	-	CO_2	68.92	98.00	68.92	0.05	17.1%	17.1%
3.B.6.b	Land Converted to Other land	-	CO_2	23.45	2.44	23.45	0.05	16.2%	33.3%
1.A.1	Energy Industries	Liquid fuels	CO_2	149.48	181.15	149.48	0.04	14.7%	48.0%
3.B.1.b	Land Converted to Forest land	-	CO_2	-87.49	-98.70	87.49	0.04	12.5%	60.6%
3.A.1	Enteric Fermentation	-	CH_4	14.95	5.17	14.95	0.02	7.7%	68.3%
3.B.3.b	Land Converted to Grassland	-	CO_2	20.84	13.73	20.84	0.02	6.2%	74.5%
4.A	Solid Waste Disposal	-	CH_4	35.85	45.90	35.85	0.02	5.3%	79.7%
3.B.2.b	Land Converted to Cropland	-	CO_2	16.49	10.33	16.49	0.01	5.2%	85.0%
4.D	Wastewater Treatment and Discharge	-	CH_4	4.96	12.21	4.96	0.01	4.9%	89.9%
1.A.4	Other Sectors	Liquid fuels	CO_2	12.59	7.04	12.59	0.01	4.6%	94.5%
3.B.5.b	Land Converted to Settlements	-	CO_2	3.39	0.75	3.39	0.01	2.1%	96.5 %

Table 3-8. IPCC Key Source Categories for 2018, Approach 1

IPCC Category code	IPCC Category		Greenhouse gas	Key categories L= level, T=trend
1.A.1	Energy Industries	Liquid fuels	CO_2	L, T
1.A.3.b	Road Transportation	-	CO_2	L, T
1.A.4	Other Sectors	Liquid fuels	CO_2	L, T
3.A.1	Enteric Fermentation	-	CH_4	T
3.B.1.a	Forest land Remaining Forest land		CO_2	L
3.B.1.b	Land Converted to Forest land	-	CO_2	L, T
3.B.2.b	Land Converted to Cropland	-	CO_2	L, T

IPCC Category code	IPCC Category		Greenhouse gas	Key categories L= level, T=trend
3.B.3.b	Land Converted to Grassland	-	CO_2	L, T
3.B.5.b	Land Converted to Settlements	-	CO_2	T
3.B.6.b	Land Converted to Other land	-	CO_2	T
4.A	Solid Waste Disposal	-	CH_4	L, T
4.D	Wastewater Treatment and Discharge	-	CH_4	L, T

Most of the 12 key categories are from the LULUCF sector (5): 3 categories are CO_2 emissions from fuel combustion which are both level and trend, followed by 2 CH_4 level and trend key categories (4.D Wastewater Treatment and Discharge and 4.A Solid Waste Disposal) and 1 CH_4 trend key categories from agriculture sector (3.A.1 Enteric fermentation).

Key category analysis as a base for prioritizing improvements in GHG inventory

Key source categories are to receive special considerations in terms of improvements and QA/QC. In **Error! Reference source not found.**, methodologies used to calculate emissions from the key categories are presented.

In principle the improvements for the Energy related categories are to focus on the robustness of the activity data and to replace some assumptions with statistical data gathered for that specific purpose. Improvements in the calculation factors such as NCV and EF are not to be foreseen since in the key source categories only commercial fuels are used which are standardised.

Waste related emissions could be improved through both activity data and emission factors, with the focus on the determination of the share of biodegradable waste in solid waste composition, and in-situ verification of the structure and nature of the landfill sites.

Subject to the available resources, emission estimates should also be improved in the agriculture sector, primarily through the improvement of the activity data since both manure management and enteric fermentation are only trend Key source categories.

Table 3-9. Methodologies Used for Key Categories According to the Level in 2018

IPCC Category code	IPCC Category		Greenhouse gas	Methodology	EF and other parameters
1.A.1	Energy Industries	Liquid fuels	CO_2	Tier 1	D
1.A.3.b	Road Transportation	-	CO_2	Tier 1	D
4.A	Solid Waste Disposal	-	CH_4	Tier 1	D
4.D	Wastewater Treatment and Discharge	-	CH_4	Tier 1	D
1.A.4	Other Sectors	Liquid fuels	CO_2	Tier 1	D
1.A.2	Manufacturing Industries and Construction	Liquid fuels	CO_2	Tier 1	D
3.A.1	Enteric Fermentation	-	CH_4	Tier 1	D
3.B.1.a	Forest land Remaining Forest land	-	CO_2	Tier 1	D
3.B.1.b	Land Converted to Forest land	-	CO_2	Tier 1	D
3.B.2.b	Land Converted to Cropland	-	CO_2	Tier 1	D
3.B.3.b	Land Converted to Grassland	-	CO_2	Tier 1	D
3.B.5.b	Land Converted to Settlements	-	CO_2	Tier 1	D

3.7 General Assessment of Completeness

Sources and sinks

All sources of direct GHG gases, included in the IPCC Guidelines, are covered by the inventory with exception to some sub-categories where emissions are currently not estimated and are included in the GHG Inventory Improvement plan.

Gases

All direct GHGs with exception of F-gases from sources subject to the implementation of the GHG Inventory Improvement plan.

Geographic coverage

The geographic coverage is complete. No territory in St. Kit and Nevis has been left uncovered by the inventory.

Notation keys

NO (not occurring)

This notation key is used for activities or processes in a particular source or sink category that do not occur within a country. The highest number of source categories marked with NO is found in the AFOLU sector, but there are some in industrial processes and energy industries as well.

NE (not estimated):

There are several sub-categories marked with NE such as:

- 1.A.1.c Manufacturing of Solid fuels and other energy industries
- 3.a Domestic Aviation
- 3.d. Domestic Navigation
- Memo Item: International Aviation
- 2D1 Lubricant use
- 2D2 Paraffin Wax Use
- 2D3 Solvent Use
- 2F1a Refrigeration and stationary Air Conditioning
- 2F1b Mobile Air Conditioning
- 2G1b Use of Electrical Equipment
- 3D Agriculture soils
- 3G Liming
- 3J Other
- 4G Harvested wood products

None of the sub-categories noted as “NE” are expected to be a Key Source Category once GHG emissions are estimated.

IE (included elsewhere):

There are a few categories marked with IE because relevant data was not available on the reporting level and emissions are therefore included in some other categories. These sources are:

- All consumption of diesel/ gasoline for domestic navigation and leisure boats are currently included under the Road Transport.

In addition, notation key IE is used also for some categories in the LULUCF sector, when IPCC methodology requires that emissions are reported in the Agriculture sector. These sources are:

- Indirect N_2O emissions from Managed soils (CRF table 4(IV)) are reported in the Agriculture sector under Agriculture Soils – Atmospheric Deposition.
- Direct N_2O emissions from M Mineralization/Immobilization from FL and GL converted to CL are reported under relevant category (3.D.1.5) under Agriculture Soils.

NA (not applicable):

This notation key is used for activities in a given source/sink category that do not result in emissions or removals of a specific gas. Categories in the CRF for which "NA" is applicable are shaded so they do not need to be filled in.

C (confidential)

For the preparation of the GHG Inventory no data received were considered confidential for the purpose of the preparations of St. Kitts and Nevis GHG Inventory.

3.8 Improvement planning

Improvement planning is an essential element of the yearly reporting cycle contributing to the quality of the GHG inventory estimates. Improvements are in principle initiated through the internal or external reviews of the GHG inventory. Since this is the first cycle of the GHG emission estimates for the period 2008-2018 for St. Kitts and Nevis, the improvements reflect the identified gaps or deficiencies identified by the inventory compilers.

Improvement planning is subject to assessment of the different priority levels:

LOW: emission estimates are not likely to present as a key source category and do not have effects on national total GHG emissions (e.g., better allocation of emissions among the different source categories).

MEDIUM: emission estimates are not likely to become a key source category and could have some limited effect on national total GHG emissions.

HIGH: emission estimates have a potential to become a level key source category or could have more substantive effect on national total GHG emissions.

VERY HIGH: emission estimates have a potential to become a level key source category or could have significant effect on national total GHG emission levels and could affect the trend of the evolution of national GHG emission.

Detailed table on the planned improvements is presented in Section 4.10.

Energy Sector

Activity data improvements and full implementation of the top-down approach

During the preparation of the GHG inventory for the period 2008-2018 the time-series inconsistencies have been identified in the data received from St. Kitts and Nevis Custom Department. Those identified inconsistencies apply only to the imports of Diesel fuel, Gas oil and Liquefied Petroleum Gas, where fluctuations in the data present a time-series outlier. It also has to be noted that Customs Department is in the process of implementation of quality improvements and migration of data, which may also contribute to the inconsistencies in the period 2008-2018. It is expected that for the future submissions, a consistent top-down time-series will be developed which will allow for the preparation of the comparison of GHG emissions from Energy Sector using top-down approach and bottom-up approach.

Determination of the fuels used in international navigation and aviation

Fuels used for international navigation and international aviation are according to the IPCC methodology. Memo items shall not be included in the national totals; therefore it is important to have a quality data on those fuel consumptions. For the subsequent submission and with full implementation of the MRV system in St. Kitts and Nevis it is expected that the quality of those data will improve significantly.

Better allocation of data in Manufacturing Industries and Construction, Road Transport Sector and Other

Once the MRV system is established and fully functional, the quality of sectoral data will improve and therefore the reliance of the results of the past projects or GHG estimates using fall-back approaches and assumption based on sectoral drivers will not be needed.

Industrial Processes and Product Use

The main priority for future improvements is to prioritise efforts to estimate emissions from

- 2F1a Refrigeration and stationary Air Conditioning
- 2F1b Mobile Air Conditioning

where the majority of the emissions from IPPU is expected to occur. This should take into account that hospitality businesses and the commercial sector extensively use stationary air conditioning systems, while air conditioning is also increasing in households. In addition to taking into account that passenger cars, vans and busses are predominantly equipped with AC road transport sectors and mobile air conditioning. Leakages from those systems also need to be estimated.

Once those emissions are estimated the remaining categories where emissions are expected, such as 2D1 Lubricant use, 2D2 Paraffin Wax Use, 2D3 Solvent Use and potentially 2G1b Use of Electrical Equipment, will be addressed.

AFOLU

The main priority for future improvements in the Agriculture sector is to prioritise in-country data collection efforts for the following inputs:

- Livestock count (2000-2018) for both St. Kitts and Nevis
- Fertiliser imports (2000-2018)
- Urea sales from sole distributor (2000-2018)

At present, emission estimates are mainly based on the use of international datasets for the timeseries 2000-2018. Improvement in data collection and country-specific datasets would allow for validation of the input parameters used during the GHG inventory process.

In the Forestry and Other Land Use (FOLU) sector, the main priority for future improvements builds upon initial ground truthing activities during the GHG inventory reporting cycle and the development of country specific emission factors and activity data. The following activities have been identified:

- Field Survey and Measurements to develop country specific emission factors
- Generating emission factors for forest, grasslands, and wetlands with woody vegetation
- Capacity building training on GIS

Waste

The main priority for future improvements in the waste sector is to prioritise in-country data collection efforts for the following input parameters:

- Waste tonnage values at Solid Waste Disposal Sites disaggregated into the appropriate IPCC categories
- Country specific waste composition percentages
- Urbanisation percentages for the population of St. Kitts and Nevis disaggregated into rural, urban high and urban low income
- Industrial solid waste values deposited at Solid Waste Disposal Sites

Chapter 4 OVERVIEW OF TRENDS IN GREENHOUSE GAS EMISSIONS

4.1 Description of Emission Trends for Aggregated GHG emissions

Total emissions of GHG in 2018, sinks not considered, amounted to 363.5 kt CO_2 eq., which represents a 15.5% increase of emissions compared to the year 2014 and 21.2% increase compared to 2008. In the period 2008-2012, a slight reduction of emissions was recorded (-1.9%) due to the economic conditions at that time. However, from 2013, emissions have a stable increasing trend which can be attributed to the increased economic activity and strong contribution of the tourism sector since the number of tourists visiting St. Kitts and Nevis in 2013 onwards has increased by 84.1%, while revenues from the tourism industry almost tripled. The positive macroeconomic trends are driving the emissions in all sectors upwards, with exception of agriculture emissions where a slight decline in GHG emissions has been observed mainly due to reduced activities in this sector.

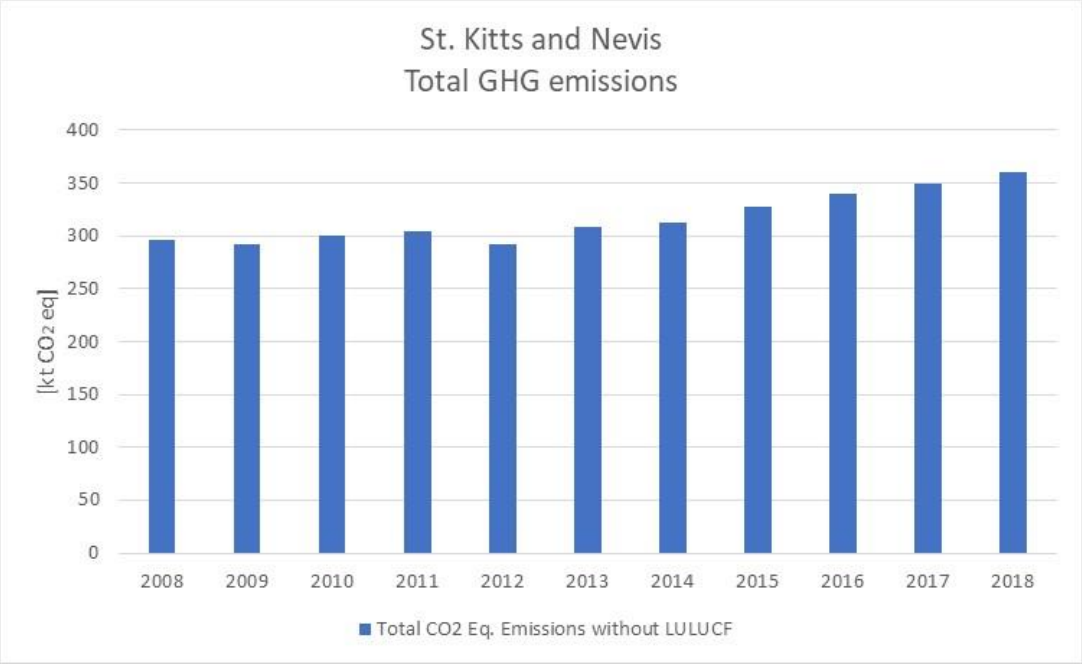


Figure 4-1: St. Kitts and Nevis - Total GHG emissions (w/o LULUCF)

Note: LULUCF sector is currently not included in the emissions estimated due to significant variations in emissions/sinks due to land use change which is driven by the uncertainties identified in the land use remote sensing approach

4.2 Description of Emission Trends by Gas

CO_2 emissions in 2018 represented 80.4% of overall emissions of greenhouse gases. CO_2 emissions excluding LULUCF followed the consumption of energy and with regard to their fraction and exerted a major impact on total emissions. Compared to 2014, CO_2 emissions increased by 17.3% in 2018. The share of CO_2 emissions in the total GHG emissions has slightly increased since it was 78.5% and 79.1% in 2008 and 2014 respectively, which is indicating that emissions in the Energy sector is growing faster than in the other sectors (Waste, Agriculture).

CH_4 emissions represented 12.8% of total emissions in 2018 and were 6. 8% higher than in 2014 and 12.8% higher compared to 2008 emissions. N_2O emissions represented 1.9% of total emissions and were 28.5% higher than N_2O emissions in 2014 and 7.1% lower compared to 2008.

Emissions from F-gases were at this stage not estimated and are expected to be estimates through the implementation of the improvement plant.

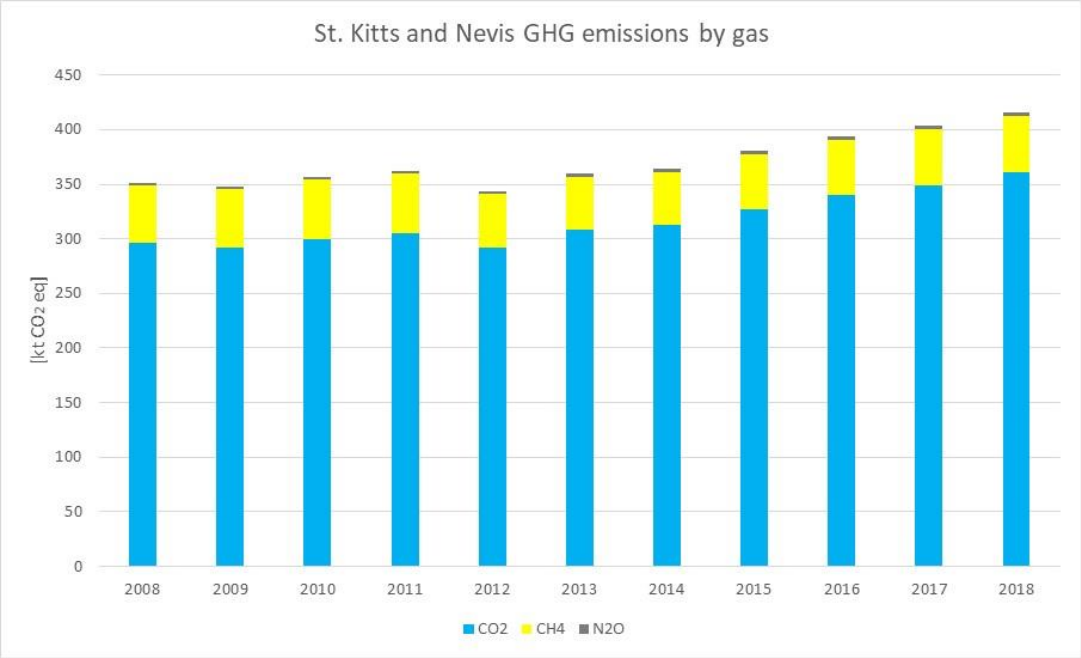


Figure 4-2: St. Kitts and Nevis GHG Emissions Trend by Gas (w/o LULUCF)

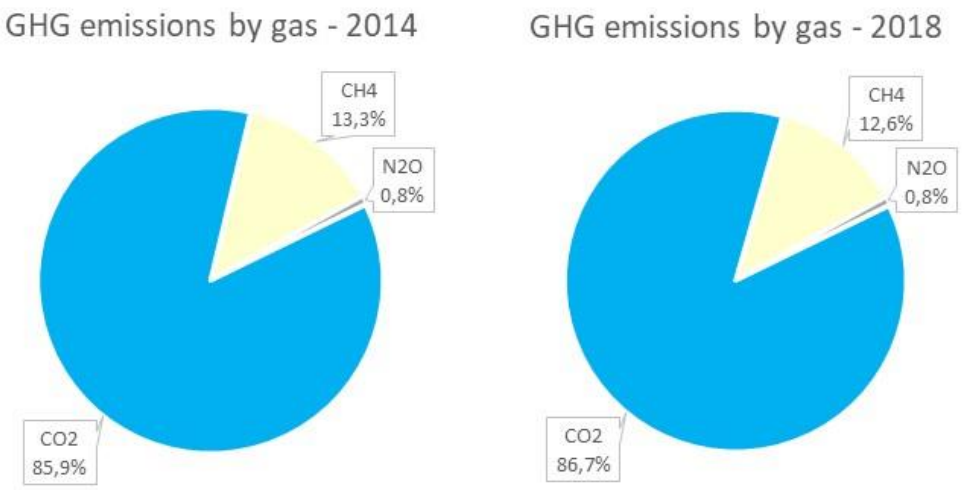


Figure 4-3: St. Kitts and Nevis GHG emissions by Gas in 2014 and 2018 (w/o LULUCF)

4.3 Description of Emission Trends by Sector

According to the UNFCCC Reporting Guidelines, emissions estimates are grouped into five IPCC categories: Energy, Industrial Processes and Product Use, Agriculture, Land Use, Land-Use Change and Forestry, and Waste (Figure 4-4, below).

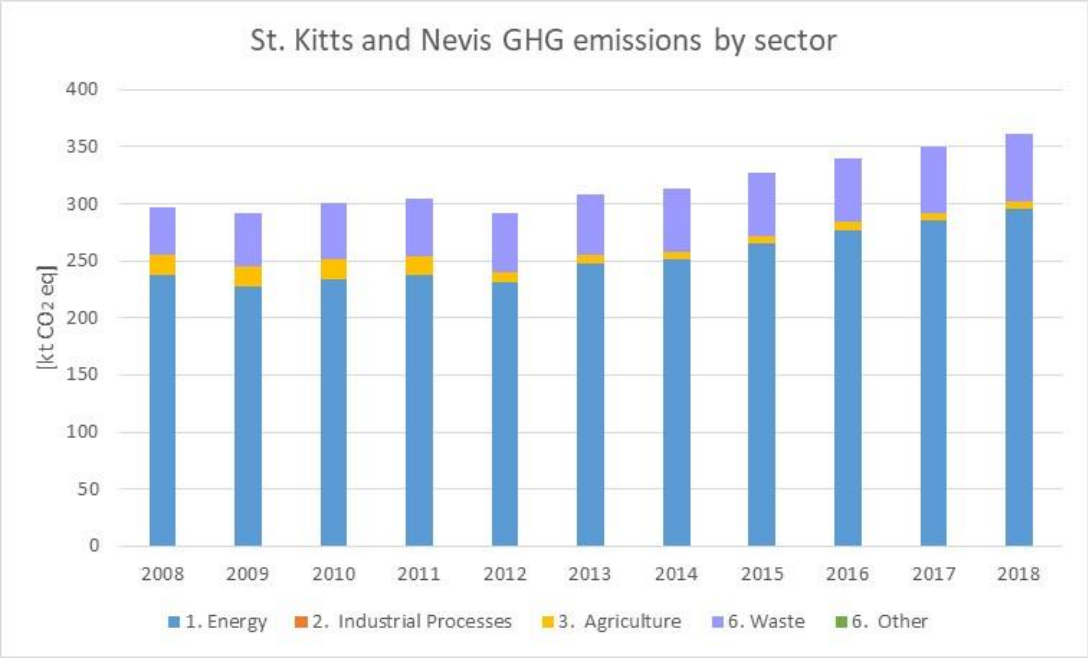


Figure 4-4 GHG Emissions in St. Kitts and Nevis by sector

By far the most important sector is Energy, which in 2018 accounted for 81.7% of total GHG emissions. In this sector emissions have increased by 17.3%, compared to estimates in 2014.

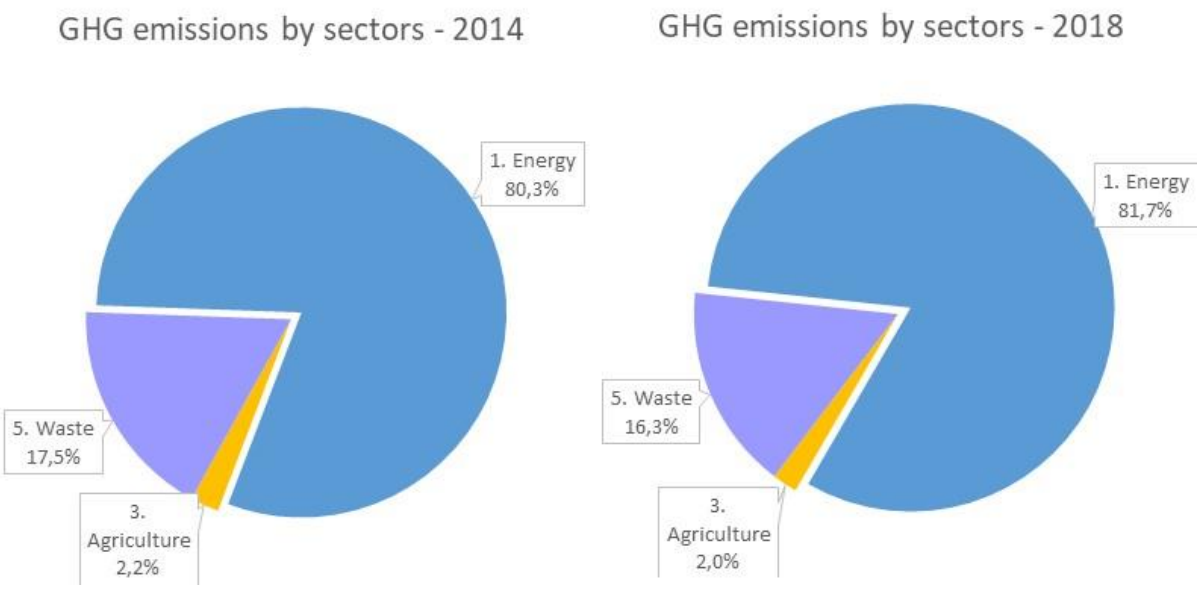


Figure 4-5: St. Kitts and Nevis GHG emissions by Sector in 2014 and 2018 (w/o LULUCF)

Within this sector, in the period 2008–2018, GHG emissions from the Energy Industry, as the biggest sub-sector accounted for 61.6% of Energy emissions, increasing by 21.2%. For the period 2014–2018, steep growth (+13.4%) has been recorded due to the increased consumption of electrical energy.

Undoubtedly the greatest increase in GHG emissions was observed in the transport sector, by as much as 41.6% until 2008, due to the increase in road transportation, while emissions from other kinds of traffic such as rail also significantly increased. In the period after 2008, GHG emissions from transport decreased and reached the lowest point in 2011 (- 24.4% compared to 2008) due to the spill-off effects of the global financial crisis which significantly affected the tourism industry. Since 2011 the GHG emissions from transport were observed to have a strong increasing trend and had doubled by 2018 (+87.1%).

There was a modest increase of GHGs from the Manufacturing industry and Construction between 2008 and 2018 (+33.7%) with the focus on Construction which represents 97.4% of

the GHG emissions in this sector. It is expected that after 2018, emissions from manufacturing industries will decrease due to the closure of the production of incandescent bulbs in St. Kitts and Nevis.

Emissions from the Other sectors which includes Households and Other Commercial use fluctuates a lot from year to year and have in general a slightly decreasing trend resulting in 10.6% emission reductions in the period 2014-2018.

Fugitive emissions from fuel represent only 0.001% of emissions in the Energy sector and have since 2014 increased by 8.3% mainly due to the increase in transport and storage of LPG.

Emissions from Industrial Processes are, in the majority of sub-sectors, not occurring since there are no such industrial installations in St. Kitts and Nevis. In sub-sectors where GHG emissions are expected – such as 2D non-Energy Products from Fuels and Solvent use with 2D1 Lubricant Use and 2D2 Paraffin wax – GHG emissions have not yet been estimated, which also applies to 2F1a Refrigeration and Stationary Air conditioning and 2F1b Mobile Air conditioning. Estimation of GHG emissions from currently not estimated sectors are included in the improvement plan and will be estimated in the subsequent GHG reporting cycle.

In Agriculture as the third most important sector, emissions in 2018 amounted to 9.45Gg CO_2 eq, which represents 2.6% of all emissions. Agriculture represents a rather minor source of CH_4 and major source of N_2O emissions. Namely only 9.0% of all CH_4 emissions and as much as 53.8% of all N_2O emissions. In the Agricultural sector, CH_4 emissions accounted for 61.4% of emissions and N_2O emissions accounted for 38.5% of emissions, while CO_2 emissions accounted for only 0.1%. GHG emissions from Agriculture show some oscillations for individual years, but the general trend since 2008 is decreasing with exception of 2018. In 2018, emissions were 13.5% above the 2014 levels. The most important sub-sector represents emissions from enteric fermentation, which contributes 54.7% of all emissions from agriculture, followed by emissions from agricultural soils and manure management, with 44.4% and 20.9%; the remaining emissions (0.1%) are contributed by CO_2 emissions from Urea application.

The total net removals/sinks of CO_2 from the LULUCF sector were not included in the national totals due significant variations of emissions which can be contributed to the uncertainty of the methodology applied in this initial stage of the emission estimates from LULUCF. Namely the quality control of the initial estimates shows that majority of the emissions/sinks are coming

from land use and land use change matrix which is derived from satellite images, which for the period 2005-2015 contains irregularities and reflections and therefore cannot be used for the land use interpretation.

Methane emissions from the Waste sector are the largest source of CH_4 and represents 16.2% of all GHG emissions in St. Kitts and Nevis in 2018 and 90.3% of all CH_4 emissions. The fraction of CH_4 emissions in this sector amounts to 98.8%, while the remaining part represents N_2O (1.2%) and CO_2 emissions (0.1%). Solid waste handling contributes 77.9% to the total emissions from this sector, wastewater handling 21.9%, incineration of waste 0.2%.

Emissions in 2018 were 7.4% higher than in 2014. Emissions from solid waste disposal started steadily increasing since 2008 (+28.1%) due to increase in population and as the result of positive macroeconomic development. Emissions are rapidly increasing from Wastewater treatment and discharge, where emissions since 2008 more than doubled and are mainly driven by the trends in the tourism sector.

Table 4-1. GHG Emissions and Removals in St. Kitts and Nevis (in kt CO_2 eq.) by Sectors and Sub-sectors, 2008-2018.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change to BY	Change to PY
Total CO_2 Eq. Emissions without LULUCF	**299,99**	**295,77**	**303,63**	**308,22**	**294,24**	**309,77**	**314,74**	**329,21**	**341,95**	**350,84**	**363,54**	**15.5%**	**21.2%**
Total CO_2 Eq. Emissions with LULUCF	**234,14**	**229,92**	**237,78**	**217,73**	**203,75**	**219,29**	**201,65**	**216,12**	**228,86**	**237,74**	**250,44**	**24.2%**	**7.0%**
1. Energy	238,00	227,79	234,39	238,03	231,81	247,49	251,58	264,71	277,03	284,88	295,17	17.3%	24.0%
A. Fuel Combustion	238,00	227,79	234,39	238,03	231,81	247,49	251,58	264,71	277,03	284,88	295,17	17.3%	24.0%
1. Energy Industries	149,97	162,74	167,95	171,24	163,15	159,91	160,31	167,61	176,47	175,51	181,74	13.4%	21.2%
2. Man. Ind. & Constr.	4,43	4,25	4,22	4,39	4,42	4,67	4,92	5,17	5,42	5,67	5,92	20.3%	33.7%
3. Transport	70,96	50,63	52,51	53,68	56,29	75,08	78,44	83,95	88,51	95,56	100,44	28.1%	41.6%
4. Other Sectors	12,64	10,18	9,71	8,72	7,96	7,83	7,91	7,98	6,63	8,14	7,07	-10.7%	-44.1%
5. Other	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-	-
B. Fugitive Emissions from Fuels	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5.3%	-40.9%
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
2. Oil and Natural Gas and other…	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	-5.3%	-40.9%
2. Industrial Processes	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	-	-
A. Mineral Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
C. Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
D. Non-energy products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
E. Electronics industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
F. Product uses as ODS substitutes	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-	-
G. Other product manufacture and	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-	-
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
3. Agriculture	20,44	20,39	20,39	19,48	10,62	9,68	8,33	8,69	8,26	8,20	9,45	13.5%	-53.8%
A. Enteric Fermentation	14,95	14,95	14,95	14,08	7,11	6,48	5,18	5,59	5,19	5,17	5,17	-0.2%	-65.4%
B. Manure Management	2,36	2,37	2,37	2,49	1,96	1,91	1,86	1,92	1,92	1,91	1,98	6.1%	-16.2%
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
D. Agricultural Soils	3,12	3,06	3,06	2,91	1,54	1,28	1,28	1,17	1,13	1,11	2,29	79.3%	-26.6%

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change to BY	Change to PY
E. Prescribed Burning of Savannahs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
F. Field Burning of Agricultural	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
G. Liming	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-	-
H. Urea applications	0,01	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,01	0,00	0,01	250.0%	-6.7%
I. Other carbon-containing	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-	-
4. Land Use, Land-Use Change and Forestry	-65,84	-65,84	-65,84	-90,49	-90,49	-90,49	-113,10	-113,10	-113,10	-113,10	-113,10	0.0%	71.8%
A. Forest Land	-	-	-	-	-	-	-	-	-	-	-	0.0%	7.9%
B. Cropland	16,49	16,49	16,49	22,58	22,58	22,58	10,33	10,33	10,33	10,33	10,33	0.0%	-37.4%
C. Grassland	20,84	20,84	20,84	30,75	30,75	30,75	13,73	13,73	13,73	13,73	13,73	0.0%	-34.1%
D. Wetlands	0,00	0,00	0,00	0,14	0,14	0,14	0,00	0,00	0,00	0,00	0,00	-	-
E. Settlements	3,39	3,39	3,39	3,13	3,13	3,13	0,75	0,75	0,75	0,75	0,75	0.0%	-77.8%
F. Other Land	23,45	23,45	23,45	4,55	4,55	4,55	2,44	2,44	2,44	2,44	2,44	0.0%	-89.6%
G. Harvested wood products	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-	-
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-
5. Waste	41,55	47,59	48,85	50,71	51,81	52,61	54,84	55,81	56,66	57,76	58,92	7.4%	41.8%
A. Solid Waste Disposal	35,85	36,97	38,18	39,31	40,35	41,09	42,04	42,96	43,76	44,80	45,90	9.2%	28.0%
B. Biological treatment of solid	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-	-
C. Incineration and open burning of	0,12	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,14	3.2%	8.7%
D. Waste water treatment and	5,58	10,50	10,54	11,27	11,33	11,39	12,66	12,72	12,77	12,83	12,88	1.7%	131.0%
E. Other	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-	-
6. Other	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-	-

Memo Items.													
International Bunkers													
Aviation	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-	-
Navigation	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	-	-
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	-	-

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change to BY	Change to PY
CO_2 Emissions from Biomass	0,14	0,14	0,14	0,14	0,14	0,16	0,16	0,16	0,17	0,17	0,17	12,2%	27,8%

4.4 Energy

Overview over the sector

The energy sector is the most important sector of GHG emissions in St. Kitts and Nevis, since in 2018 it accounted for 81.8% of overall CO_2 eq. emissions (w/o considering LULUCF). Emissions from this sector arise from fuel combustion, accounting for more than 99.9% emissions from the energy sector, and as fugitive emissions from fuels, accounting for less than 0.1% of emissions (See **Error! Reference source not found.** below).

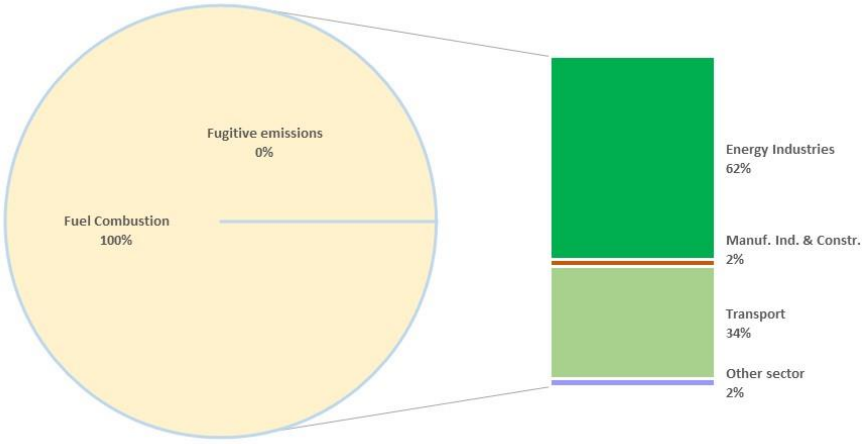


Figure 4-6. Emissions of GHG in Energy Sector by Categories in 2018

Emissions from the Energy sector are presented in the Table 4-2. Compared to 2017, GHG emissions increased by 3.6% in 2018 and were by 17.3% higher than in the 2014 and 24% higher than in 2008.

Table 4-2: Emissions from Energy sector by sources in kt $CO_{2\,eq}$

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1. Energy	238,00	227,79	234,39	238,03	231,81	247,49	251,59	264,72	277,03	284,88	295,18
A. Fuel Combustion	238,00	227,79	234,39	238,03	231,81	247,49	251,58	264,71	277,03	284,88	295,17
1. Energy Industries	149,97	162,74	167,95	171,24	163,15	159,91	160,31	167,61	176,47	175,51	181,74
2. Man. Ind. & Constr.	4,43	4,25	4,22	4,39	4,42	4,67	4,92	5,17	5,42	5,67	5,92
3. Transport	70,96	50,63	52,51	53,68	56,29	75,08	78,44	83,95	88,51	95,56	100,44

4. Other Sectors	12,64	10,18	9,71	8,72	7,96	7,83	7,91	7,98	6,63	8,14	7,07
5. Other	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Fugitive Emissions from Fuels	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas and other…	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,002	0,002	0,002	0,002

The main driver for the increasing GHG emissions trend are developments in the Transport sector, where fuel consumptions in 2018 increased by 28.1% compared to 2014 and 41.6% compared to the year 2008.

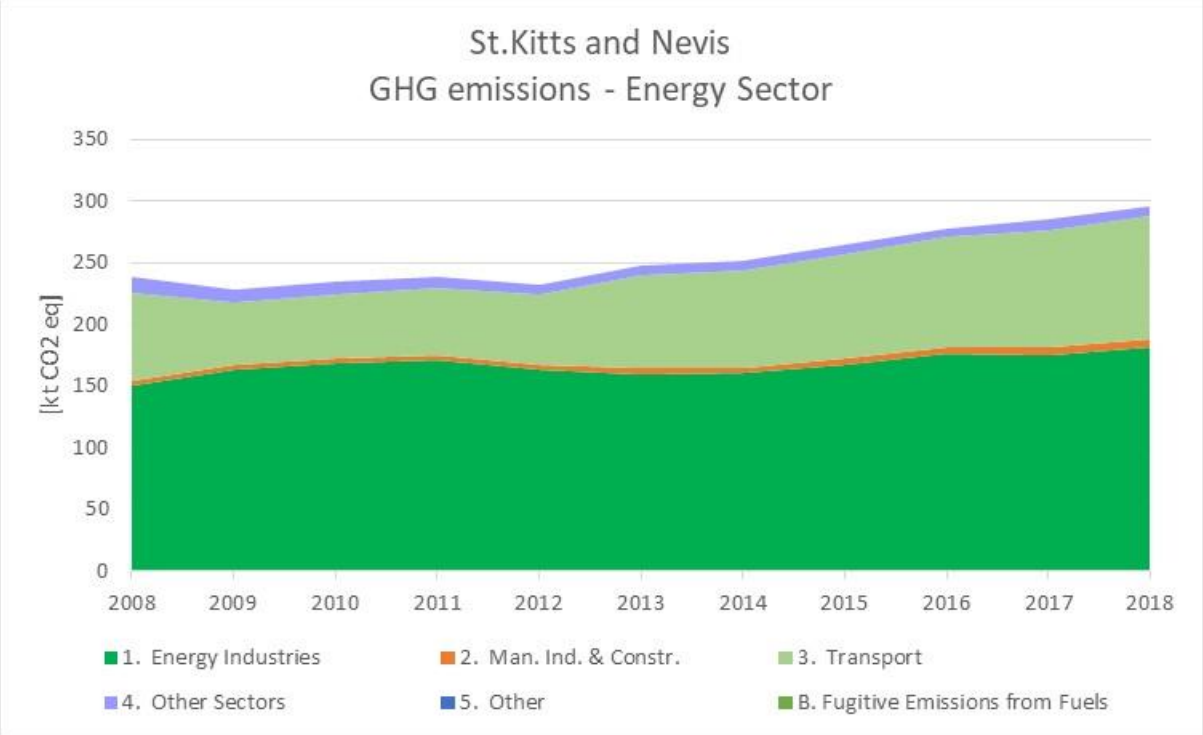


Figure 4-7. Emissions of GHG in Energy Sector by categories in 2018

Energy industries (electricity production) which are also contributing to the trend in 2018 increased emissions for 3.5% compared to previous year and 13.4% compared to 2014. The increase in emissions is a consequence of higher demand for electricity. The demand is driven by a positive macroeconomic environment mainly driven by the positive trends in the tourism sector. Lack of change in the trend for Manufacturing industries and Construction and 'Other sectors' with

Households and Commercial and other energy use; are due to the relatively small amount of emissions having a negligible effect on the overall developments of emissions in the Energy Sector.

FUEL COMBUSTION

Energy Industries

This category presents the consumption of fuels and emissions of greenhouse gases in:

- Public Electricity and Heat Production (CRF 1A1a)
- Petroleum Refining (CRF 1A1b)
- Manufacture of solid fuels and Other Energy Industries (CRF 1A1c)

Table 4-3: Structure of the Emissions from Energy Industries (in kt $CO_{2\ eq}$)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1.A.1. Energy industries	149,97	162,74	167,95	171,24	163,15	159,91	160,31	167,61	176,47	175,51	181,74
a. Public electricity and heat production	149,97	162,74	167,95	171,24	163,15	159,91	160,31	167,61	176,47	175,51	181,74
b. Petroleum refining	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c. Manufacture of solid fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

The Public electricity and heat production is the only relevant sub-category in the Energy industries. In St. Kitts and Nevis, the electricity is produced by diesel generators by two major public electricity producers SKELEC and NEVLEC. Some minor emissions are also expected to occur in the Manufacturing of solid fuels category, due to some charcoal production. However, those emissions are not yet estimated.

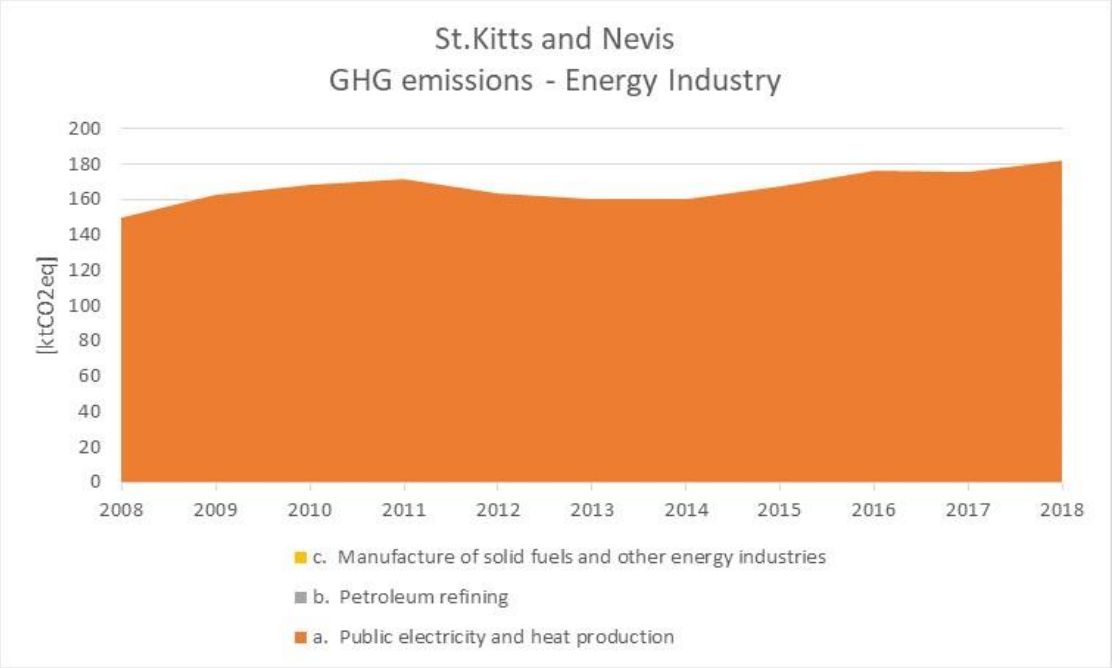


Figure 4-8. Emissions of GHG in Energy Industries in 2018

GHG emissions in 2018 reached 182 $ktCO_{2eq}$ which is an increase of 3.5% from previous year and 13.4% from 2014. In the observed period 2008-2018 there were no major disruptions in the electricity production identified in the GHG emission time-series due to extreme weather events. The electricity production slightly decreased due to macroeconomic circumstances; however, it has to be noted that in 2010 the Windwatt company commissioned Maddens wind farm on Nevis Island with eight wind turbines (each 275kW of installed capacity) and total installed capacity of 2,2MW. Further investments in the renewable sources such as photovoltaics has been announced which will be contributing to the future emission reductions in this sector.

Manufacturing industries and construction

This category presents according to CFR reporting the consumption of fuels and emissions of greenhouse gases in six specific types of industry. All others are covered by Other industry, which includes fuel for the Construction industry. According to the 2006 IPCC reporting table the same category is disaggregated to thirteen categories.

GHG emissions for St. Kitts and Nevis are allocated into two categories 1.A.2.e - Food Processing, Beverages and Tobacco and 1.A.2.k - Construction and an overview of the emission developments is presented in the

Table 4-4, below

Table 4-4: Emissions from Manufacturing Industry and Construction in kt $CO_{2\ eq}$

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1.A.2 - Manufacturing Industries and Construction	**4,43**	**4,25**	**4,22**	**4,39**	**4,42**	**4,67**	**4,92**	**5,17**	**5,42**	**5,67**	**5,92**
1.A.2.e - Food Processing, Beverages and Tobacco	0,15	0,15	0,15	0,14	0,15	0,15	0,15	0,15	0,15	0,15	0,15
1.A.2.k – Construction	4,27	4,10	4,08	4,25	4,27	4,52	4,77	5,02	5,27	5,52	5,77

GHG emissions in Manufacturing industries and construction in 2018 increased for 4.4% compared to previous year, 20.3% compared to 2014 and 33.7% compared to 2008. Within the category the waste majority (97.6%) of the emissions is allocated to 1.A.2.k Construction, while the remaining 2.6% of the emissions are allocated under 1.A.2.e Food Processing Beverages and Tobacco. The main driver for the trends is therefore the Construction sector where emissions in 2018 increased for 20.9% compared to 2014.

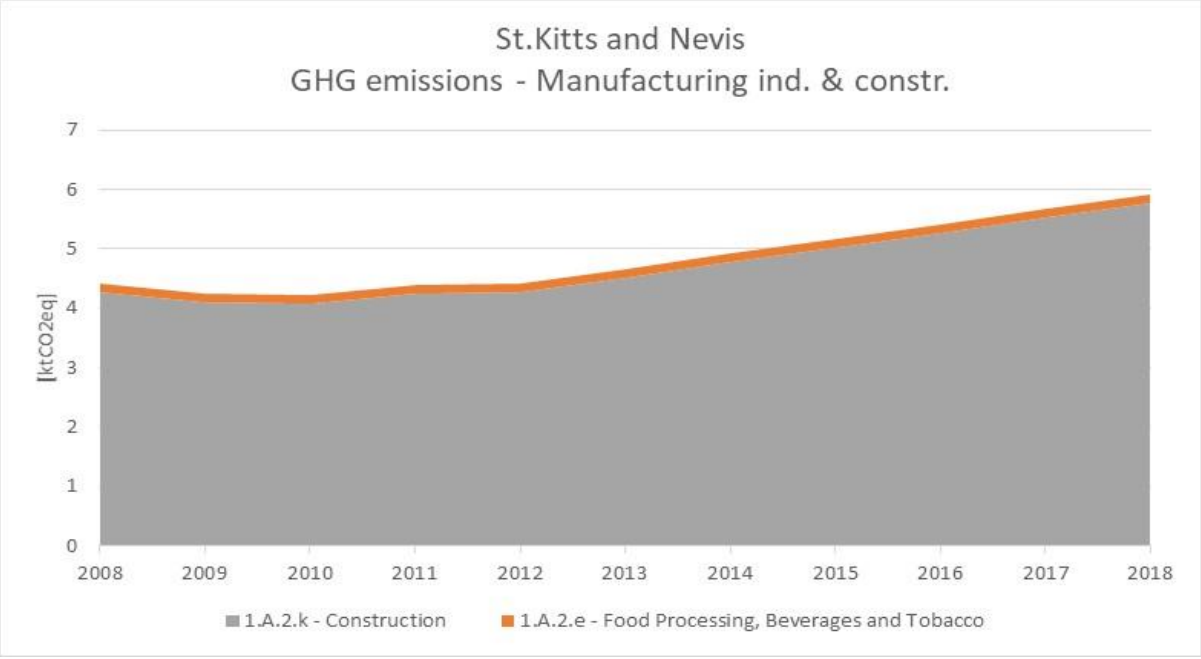


Figure 4-9. Emissions of GHG in Manufacturing Industries and Construction

Transport sector

This category presents the consumption of fuels and emissions of greenhouse gases in:

- Domestic Aviation (CRF 1A3a)
- Road Transportation (CRF 1A3b)
- Railways (CRF 1A3c)
- National navigation (CRF 1A3d)

It has to be noted that at this stage emissions from Domestic aviation (flights taking off and landing in St. Kitts and Nevis) and Domestic Navigation are not estimated. It is also expected that none of these two sub-categories will be key categories once emissions are estimated. The evolution of the emissions in this sector is presented in Table 4-5 below.

Table 4-5: Emissions from Transport in kt $CO_{2\ eq}$

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1.A.3 - Transport	**70,96**	**50,63**	**52,51**	**53,68**	**56,29**	**75,08**	**78,44**	**83,95**	**88,51**	**95,56**	**100,44**
1.A.3.b - Road Transportation	70,86	50,52	52,35	53,54	56,15	74,95	78,28	83,79	88,35	95,39	100,26
1.A.3.c - Railways	0,10	0,11	0,15	0,14	0,14	0,14	0,16	0,16	0,16	0,17	0,19

Almost all GHG emissions from the Transport Sector in St. Kitts and Nevis are coming from road transport. Emissions from railways are limited to St. Kitts Scenic Railway (29km long narrow-gauge railway) which is exclusively transporting tourists along the coastline of St. Kitts. GHG emissions from the road transport sector has increased in 2018 by 28.1% compared to 2014 and 48.6% compared to year 2008. While emissions from Railways in 2018 have increased by 15.1% and 88.9% compared to 2014 and 2008 respectively.

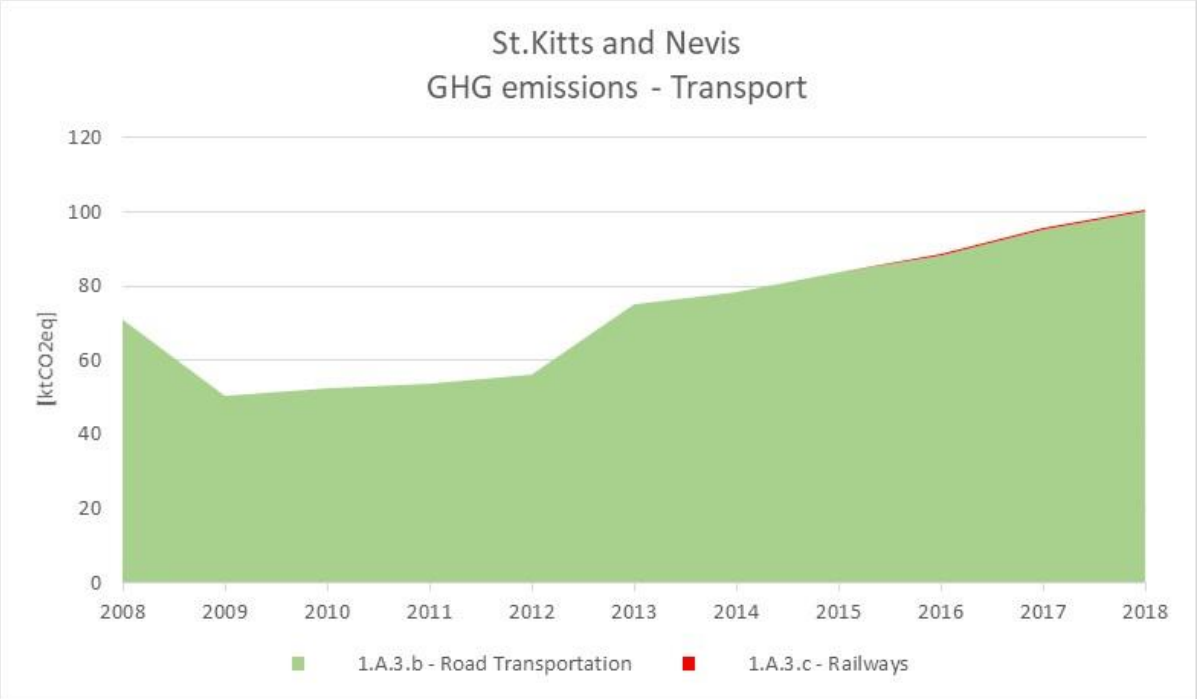


Figure 4-10. Emissions of GHG in Transport Sector

Within the Transport Sector, in 2018, emissions from cars represent 63.3% of the overall emissions in the sector which is 1.0% less than in 2018. The second largest share goes to heavy duty vehicles (HDV) and busses with 24.0% of emissions, down from 26.9% in 2008. The biggest increase in share is observed for light duty vehicles (LDV) where the share in emissions increased from 8.4% in 2008 to 12.6% in 2018.

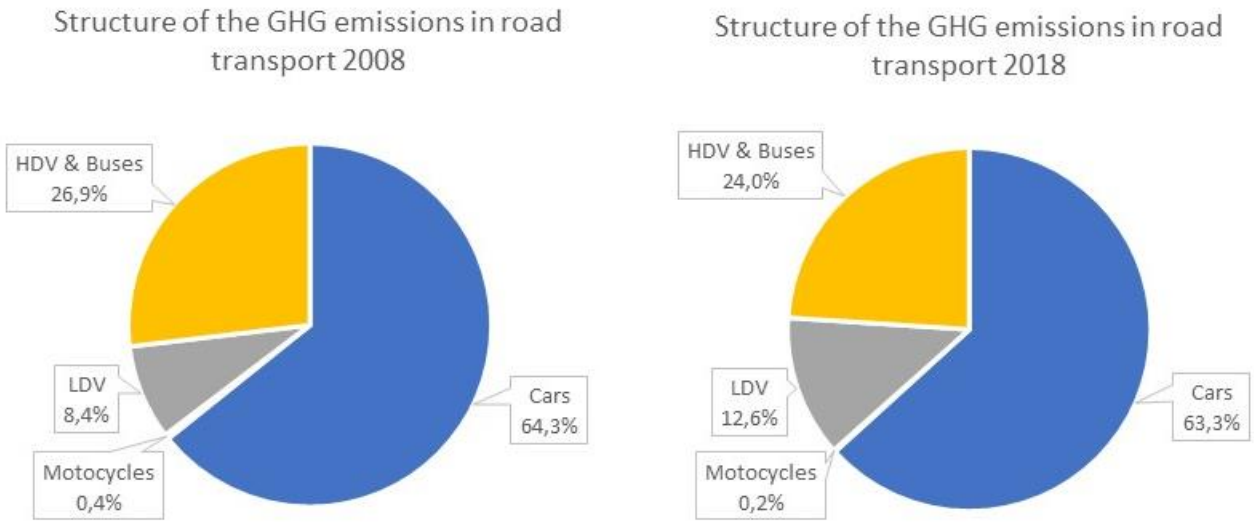


Figure 4-11. Structure of the GHG emissions from road Transport in 2014 and 2018

The majority of the vehicles imported into St. Kitts and Nevis are second-hand vehicles produced for US or Japanese markets and therefore the share of vehicles without 3-way catalysts was already small in 2008 (0.81%) and has further declined to 0.05% in 2018.

Table 4-6: Structure of the emissions from Transport in kt $CO_{2\,eq}$

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1.A.3.b - Road Transportation	70,86	50,52	52,35	53,54	56,15	74,95	78,28	83,79	88,35	95,39	100,26
1.A.3.b.i - Cars	45,54	29,73	31,56	32,78	34,73	50,86	52,90	55,58	59,38	62,57	63,42
1.A.3.b.i.1 - Passenger cars with 3-way catalysts	44,72	29,38	31,32	32,62	34,61	50,74	52,80	55,50	59,32	62,51	63,37
1.A.3.b.i.2 - Passenger cars without 3-way catalysts	0,81	0,35	0,24	0,16	0,12	0,12	0,10	0,08	0,06	0,06	0,05
1.A.3.b.ii - Light-duty trucks	5,99	4,85	5,26	5,56	5,74	7,41	8,87	9,30	10,57	12,03	12,65
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts	5,32	4,31	4,70	4,97	5,13	6,64	7,96	8,34	9,49	10,79	11,34

1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts	0,67	0,54	0,56	0,59	0,61	0,78	0,91	0,95	1,08	1,23	1,30
1.A.3.b.iii - Heavy-duty trucks and buses	19,04	15,73	15,33	15,00	15,52	16,53	16,35	18,76	18,24	20,64	24,03
1.A.3.b.iv - Motorcycles	0,29	0,22	0,20	0,19	0,16	0,15	0,15	0,15	0,16	0,16	0,17

GHG emission from cars in 2018 have increased by 19.9% compared to 2014 and 39.3% compared to 2008, while GHG emissions from LDVs (which also include vans for transport of people which operate on several bus routes) has increased by 42.6% and 111.3% respectively. Emissions from heavy duty vehicles and buses have in the same period of comparison increased by 46.6% and 26.2%. While the emissions of HDVs is mainly driven by the Commerce and Construction sectors, the LDVs mainly serve tourism and domestic transport demands.

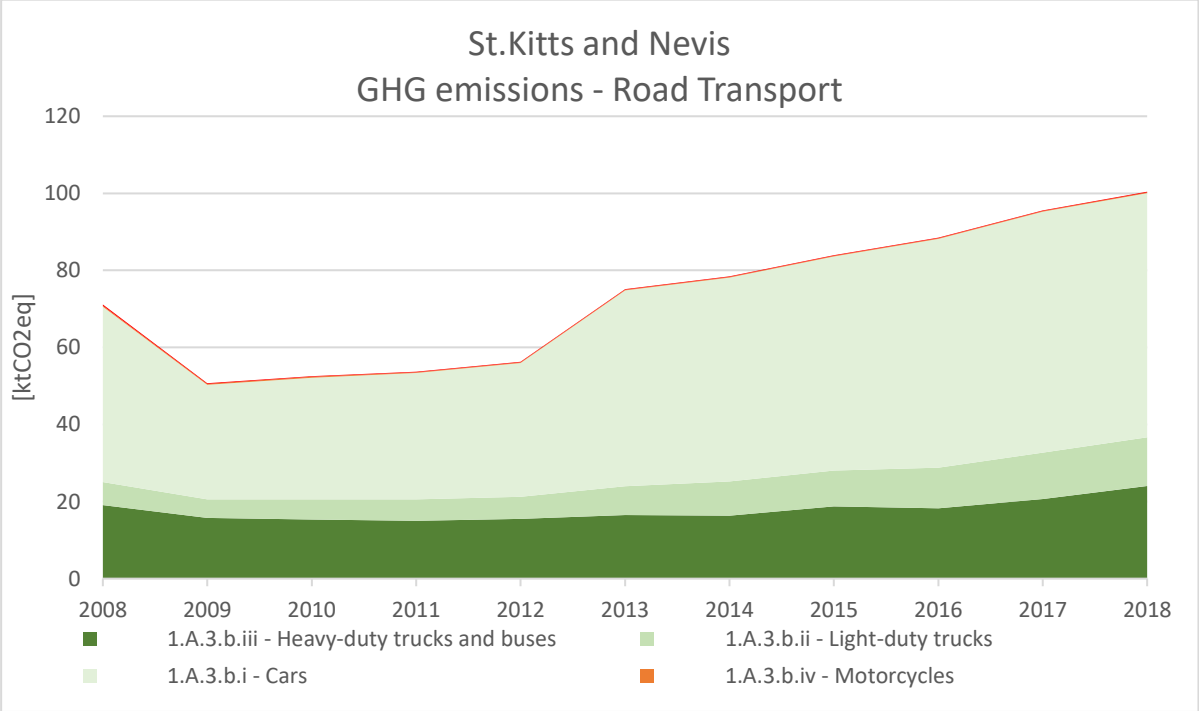


Figure 4-12. Structure of GHG Emissions in Road Transportation

Evolution of the emissions from passenger car transport is closely linked to macroeconomic environment, growth of the GDP and with increased purchasing power of St. Kitts and Nevis residents. During the observed period (2008-2018), there was a decline in emissions from 2009-2012 due to the spill-off effects of the global financial crises. Number of vehicles per capita increased

from 365 cars per thousand inhabitants in 2008 to 404 cars per thousand inhabitants in 2018 which indicates that in 2018 every household had an average of one car.

Other sector

This category presents the consumption of fuels and emissions of greenhouse gases in:

- Commercial / Institutional sector (CRF 1A4a)
- Residential sector (CRF 1A4b)
- Agriculture / Forestry / Fishing (CRF 1A4c)

GHG emissions from Other sector contain two main sub-categories: Commercial/Institutional and Residential sectors, where in 2018, 95.2% of emissions occurred. The remaining 4.8% came from Agriculture/Forestry/Fishing. Predominantly emissions came from liquid fuels (LPG) which are primarily used for food preparation both in the Residential sector and Commercial sector (Services included). In 2018 GHG emission from Other sector decreased compared to 2014 by 10.7%. This was mainly due to emission reductions in the Commercial/ Institutional sector, while emissions from households have in the same period increased by 3.9%. The main driver for the increase is the increase in population in St. Kitts and Nevis. The evolution of the emission is presented in Table 4-7 below.

Table 4-7: Structure of the emissions from Other sector in kt $CO_{2\ eq}$

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1.A.4 - Other Sectors	12,64	10,18	9,71	8,72	7,96	7,83	7,91	7,98	6,63	8,14	7,07
1.A.4.a - Commercial/Institutional	8,15	5,65	5,11	4,11	3,34	3,12	3,16	3,18	1,79	3,26	2,14
1.A.4.b - Residential	4,13	4,18	4,27	4,27	4,28	4,37	4,41	4,46	4,50	4,55	4,59
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	0,36	0,34	0,34	0,34	0,34	0,34	0,34	0,34	0,34	0,34	0,34
1.A.4.c.i - Stationary	0,36	0,34	0,34	0,34	0,34	0,34	0,34	0,34	0,34	0,34	0,34
1.A.4.c.ii - Off-road Vehicles and Other Machinery	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.A.4.c.iii - Fishing (mobile combustion)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

It has to be noted that emissions from 1.A.4.c.ii - Off-road Vehicles and Other Machinery (emissions from fuels combusted in traction vehicles on farmland and in forests) and 1.A.4.c.iii - Fishing (Emissions from fuels combusted for inland, coastal and deep-sea fishing) have not yet been estimated. Activities to estimate those emissions are included in the improvement plan.

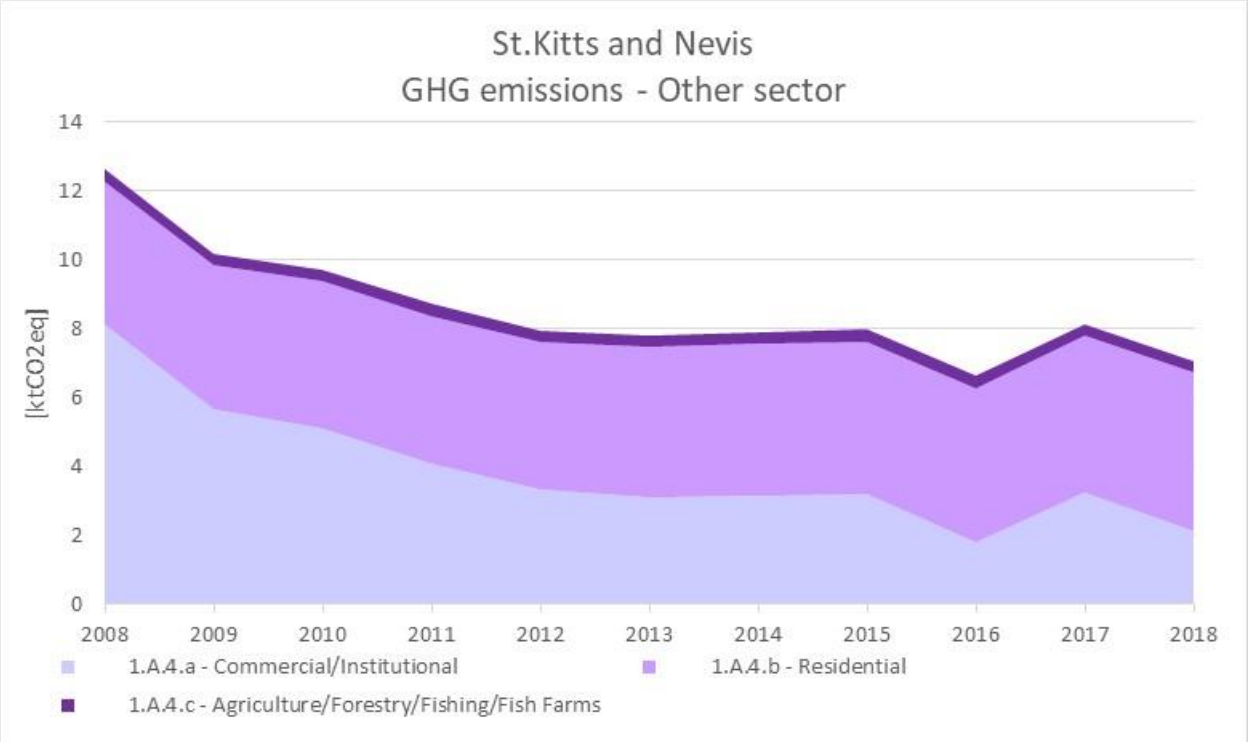


Figure 4-13. Structure of GHG Emissions in the Other Sector

Fugitive emissions from solid fuels, oil, natural gas and other emissions from energy production

This category presents the fugitive emissions of greenhouse gases from:

- Solid fuels (CRF 1.B.1)
- Oil and natural gas (CRF 1.B.2)

Fugitive emissions from solid fuels are not occurring in St. Kitts and Nevis, while fugitive emissions for oil and natural gas where fugitive emissions from LPG is to be reported are very limited and amount to 0,002ktCO_{2eq} which is 8.3% higher compared to 2018. The emissions are driven by the amount of transported LPG.

Table 4-8: Trends of Fugitive Emissions from Fuels (in kt $CO_{2\,eq}$)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1.B - Fugitive emissions from fuels	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,002	0,002	0,002	0,002
1.B.1 - Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a - Coal mining and handling	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a.i - Underground mines	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a.i.1 - Mining	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a.i.2 - Post-mining seam gas emissions	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a.i.3 - Abandoned underground mines	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO_2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a.ii - Surface mines	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a.ii.1 - Mining	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.a.ii.2 - Post-mining seam gas emissions	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.b - Uncontrolled combustion and burning coal dumps	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.1.c - Solid fuel transformation	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B.2 - Oil and Natural Gas	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,002	0,002	0,002	0,002
1.B.2.a - Oil	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,002	0,002	0,002	0,002
1.B.2.a.i - Venting	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.a.ii - Flaring	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.a.iii - All Other	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,002	0,002	0,002	0,002
1.B.2.a.iii.1 - Exploration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.a.iii.2 - Production and Upgrading	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.a.iii.3 - Transport	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,002	0,002	0,002	0,002
1.B.2.a.iii.4 - Refining	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.a.iii.5 - Distribution of oil products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.a.iii.6 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b - Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.i - Venting	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.ii - Flaring	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii - All Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii.1 - Exploration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii.2 - Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii.3 - Processing	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii.4 - Transmission and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii.5 - Distribution	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii.6 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1.B.3 - Other emissions from Energy Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

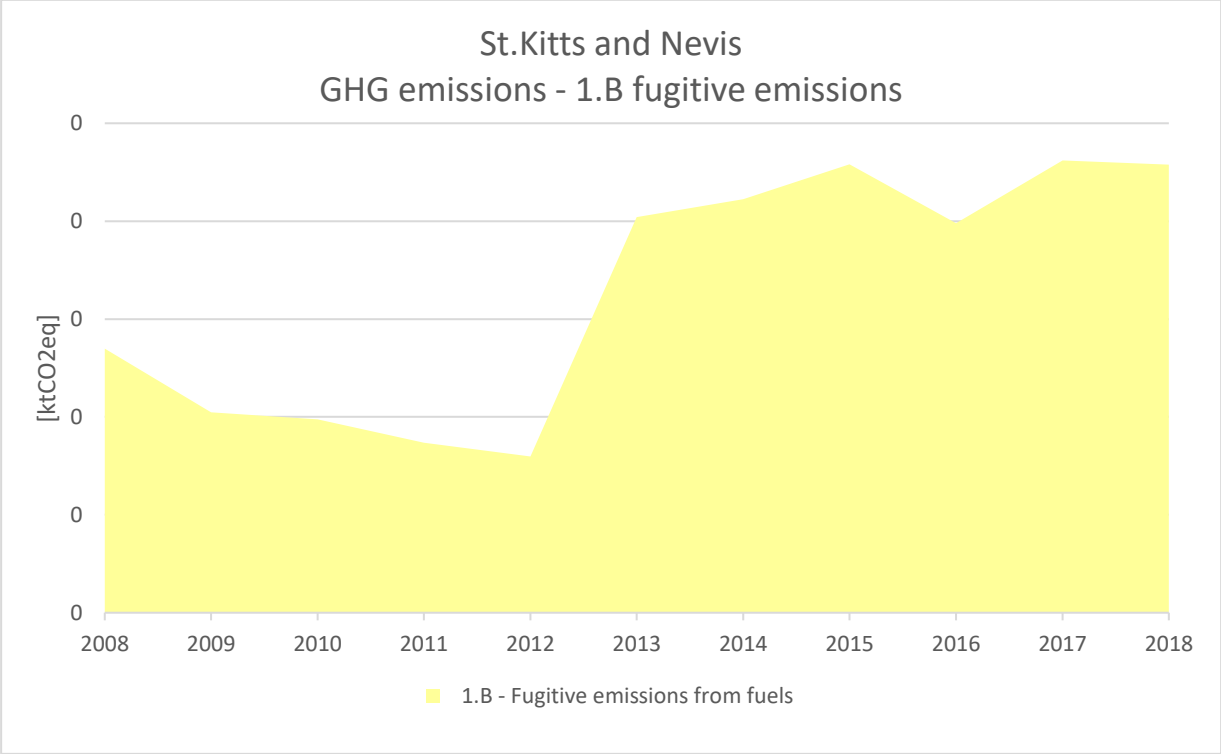


Figure 4-14. Trends in GHG Fugitive Emissions

4.5 Industrial processes and Product use

Emissions from Industrial processes are not occurring, while, from the Product use the GHG emissions are not yet estimated. It is not expected that emissions from Product use will present a level or trend key category. The estimation of the emissions from:

- 2D1 Lubricant use
- 2D2 Paraffin Wax use
- 2D3 Solvent use
- 2F1a Refrigeration and stationary Air Conditioning
- 2F1b Mobile Air Conditioning
- 2G1b Use of Electrical Equipment

This is included in the Improvement plan together with the assessment of the priority level.

4.6 Agriculture, Forestry and Other land use

Agriculture-

Overview of the Agriculture Sector

The Agriculture sector is the smallest contributor of overall GHG emissions for St. Kitts and Nevis. In 2018, GHG emission estimates accounted for approximately 2.6%of overall CO_2 equivalent emissions (without considering LULUCF). Emissions from this sector arise from Enteric Fermentation (approximately 55%), Manure Management (21%) and Managed Solid Waste (24%). It should be noted that urea application was omitted from 2018 estimates due to incomplete datasets with historical trends indicating that the overall omitted value is less than 1% of the total Agriculture sectoral GHG emissions.

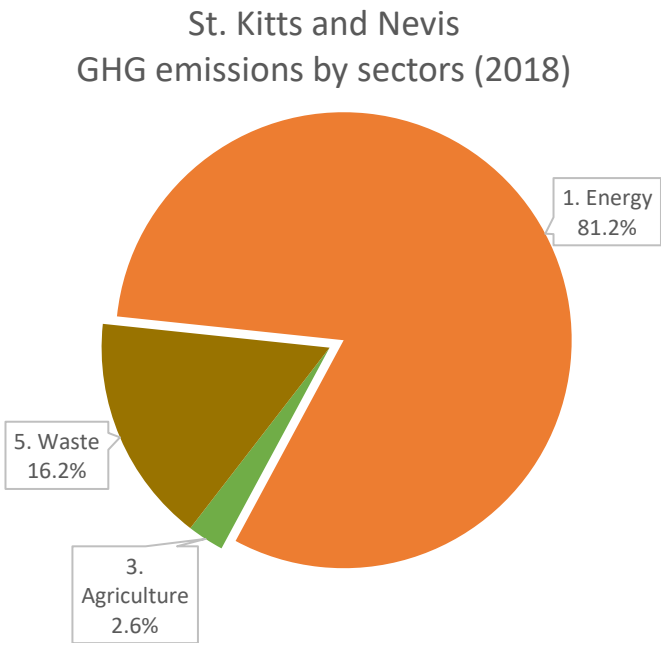


Figure 4-15. St. Kitts and Nevis GHG Emissions (2018) by Sector

GHG emissions in the Agriculture sector typically come from sources related to livestock, crop production, soil management and the application of fertilisers. The Agriculture sector in St. Kitts and Nevis accounted for 2.4% of GDP (2010) with 19.2% of the islands' total land area devoted to agriculture use. These practices include livestock production and soil enrichment from fertilisers. The Ministry of Agriculture indicated that no liming occurs in St. Kitts and Nevis with urea

amendments to soil accounted for through data provided by a local distributor. Biomass burning was not estimated as country specific data was not available.

On this basis, GHG emission estimates for the gases CO_2, CH_4 and N_2O were compiled for the Agriculture sector categories presented in Table 2.9 on the following page.

Table 4-9. Reported IPCC Categories in the Agriculture Sector

IPCC Category	IPCC Category Name
3.A.1	Enteric Fermentation (CH_4)
3.A.2	Manure Management ($CH_4$and Direct N_2O)
3.C.3	Urea Application (CO_2)
3.C.4	Managed Soils (Direct N_2O)
3.C.5	Managed Soils (Indirect N_2O)
3.C.6	Indirect N_2O emissions from Manure Management

St. Kitts and Nevis did not calculate emission estimates for enteric fermentation, manure management and managed soils in the 2nd NC submission due to lack of data and country specific information. GHG emission estimates were prepared for the timeseries 2000-2018 in an effort to improve previously submitted GHG emission estimates in the agriculture sector.

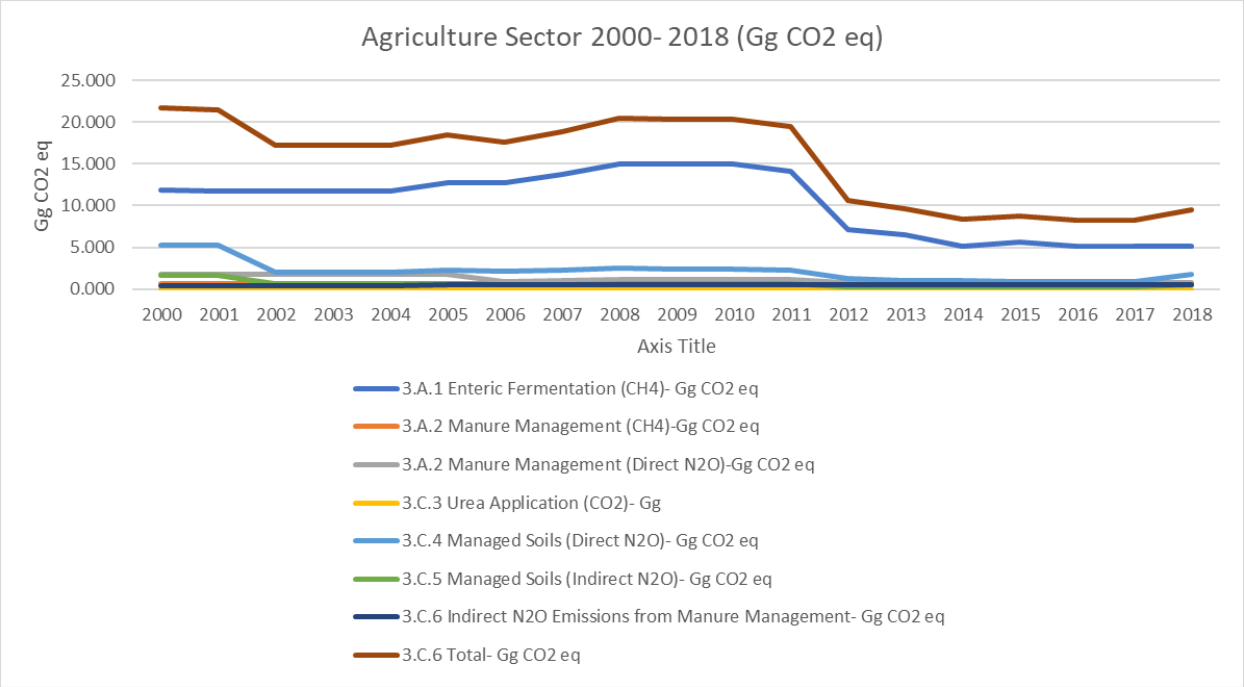


Figure 4-16. GHG Emissions Trends 2000-2018 by IPCC Sub-category

Total GHG emissions in the agriculture sector accounted for 21.657 Gg CO_2 equivalent in the year 2000 and 9.443 Gg CO_2 equivalent in the year 2018. This represents a decrease in overall sectoral emissions of approximately 56.4%.

It should be noted that emission estimates for sub-categories involving livestock used FAOSTAT datasets from 2000-2018 due to incomplete country datasets and IPCC defaults and input parameters reflective of the LAC region. In-country experts provided information on manure management system usage by livestock category which allowed for livestock associated with pasture/range/paddock allocation to be reported correctly under managed soils.

Country specific data associated with urea application accounted for two years of the 2002-2018 timeseries with the compilation team choosing to use FAOSTAT urea import data until the local dataset is extended and validated. No data on fertiliser inputs or usage was available locally with FAOSTAT data for the years 2000-2018 used for calculating emissions for indirect N_2O emissions for managed soils.

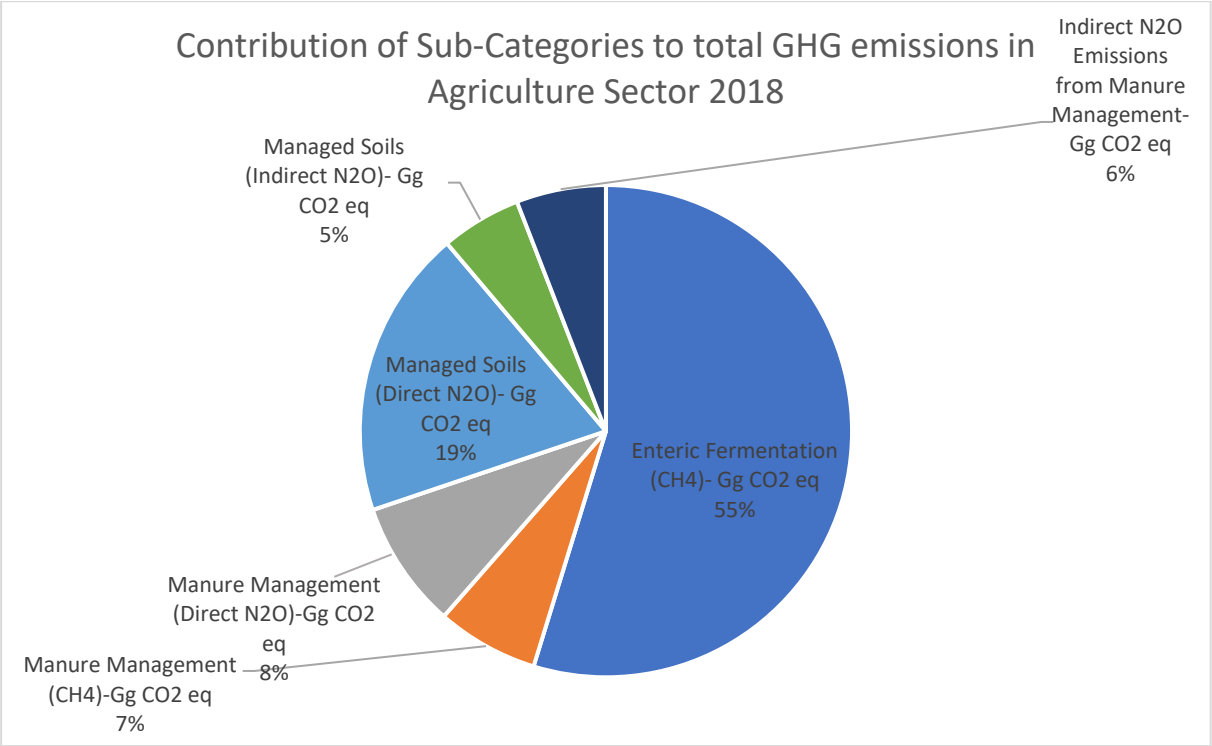


Figure 4-17. 2018 Agriculture Sector (Sub-category Profile)

In 2018, enteric fermentation (CH_4) accounts for 55% of total emissions in the agriculture sector with manure management (CH_4 and Direct N_2O) accounting for approximately 15%. Direct N_2O values for managed soils are the second highest emitting sub-category at 19%. Indirect N_2O emissions from manure management encompasses approximately 6% of the 2018 estimate with indirect N_2O emissions to managed soils from leaching and atmospheric volatilisation from managed animal waste accounting for the remaining 5%.

Figure 4-18. Share of Gases- Agriculture Sector (2008 and 2018)

Shares of the gases in total emissions have remained constant over the timeseries with CH_4 accounting for 75% and 69% in 2008 and 2018 respectively and N_2O accounting for 25%(2008) and 31% (2018). Emission estimates for CO_2 were excluded from 4-18 above as the overall value was under 0.1% of the total agriculture sectoral emissions for both 2008 and 2018.

Emission estimates for all reported sub-categories in the Agriculture sector have been included for the timeseries 2000-2018. Improvement suggestions have been highlighted in Section 4.10, as in-country experts have begun an intensive data collection effort to obtain more country-specific information in preparation for the next GHG inventory reporting cycle.

Table 4-10. GHG emissions (Gg CO_2 eq) in the Agriculture Sector (2008-2018)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
3. Agriculture	20.44	20.39	20.39	19.48	10.62	9.68	8.33	8.69	8.26	8.20	9.45
A. Enteric Fermentation	14.95	14.95	14.95	14.08	7.11	6.48	5.18	5.59	5.19	5.17	5.17
B. Manure Management	2.36	2.37	2.37	2.49	1.96	1.91	1.86	1.92	1.92	1.91	1.98
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	3.12	3.06	3.06	2.91	1.54	1.28	1.28	1.17	1.13	1.11	2.29

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
E. Prescribed Burning of Savannahs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
H. Urea applications	0.01	0.00	0.00	0.00	0.01	0.00	0,00	0,00	0,01	0,00	0,01
I. Other carbon-containing fertilisers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Forestry and Other Land Use

The Land Use sector is unique from other GHG emission reporting sectors because the Land Use sector can be both a sink and source based on land use management practices. St. Kitts and Nevis does not have a nationally approved land use map or forest inventories to access land use and land use changes. Prior National Inventory Reports (NIRs) include only the sub-category forest-lands-remaining-forestlands based on FAOSTAT data. This data showed the forest area unchanged from 1990 to 2020 with 11,000 ha of forest land in the country. To address this issue in the current NIR it was decided to include all six IPCC land classes.

St. Kitts and Nevis, like many developing countries, does not have regular forest inventory data or land use mapping that is necessary to generate activity data for calculating GHG emissions from the FOLU sector. To address this issue, Landsat satellite imagery was used to generate activity data using the Google Earth Engine platform. Classification models were built using training points from GIS land cover map 2017 of St. Kitts and Nevis and the ESRI 2020 land cover map covering both islands. Training points were digitally collected for the six IPCC land use categories - Forestland, Grassland, Cropland, Wetland, Settlement and Other land as well as an additional class scrub/shrub. The scrub/shrub sub-category was later combined with the grassland classification for GHG emission calculations. The models and classified land use maps were verified over the high-resolution satellite maps in the Google Earth Engine. Land use maps were produced for 2000, 2005, 2008, 2012 and 2018. Overall accuracy of classified maps was low, 52%-66%. Land use change was tracked spatially only for the inventory period (2008-2012) and GHG

emissions were calculated using the gain-loss method using country specific activity data and IPCC default emission factors. Above-ground and below-ground carbon pools were only included due to lack of data from other pools. Average annual emission from 2008 - 2012 was 117.8 $ktCO_2e$ which decreased to 85.8 $ktCO_2e$ during 2012-2018.

In-country experts highlighted that the FOLU sector should be a carbon sink not source. New information revealed that after the sugar industry was closed in 2005, the abandoned sugarcane fields transitioned into secondary forests and core forest areas which were 1,000 feet above sea-level and have always been protected. Therefore, it was advised to revisit the FOLU sector emission calculations with ground-truthing in an effort to validate the new information.

The GHGMI/CCMRVH FOLU expert worked with local experts to understand the history of land use in the country. In discussion with local experts, it became clear that the land below 1,000 feet above sea-level were extensively used for sugarcane farming until the sugar industry was closed in 2005. Dr. Eric Browne (forest officer) provided rough boundaries of old sugarcane fields. When the boundaries of sugarcane fields were plotted over the land cover classification maps, it became clear that most of the grasslands data provided to us in the GIS map for land use in 2017, derived from the very high-resolution satellite data (~1 m), happened to be sugarcane fields in 2000 and 2005. Recasting signatures from the GIS map of 2017 from these areas to the historical data resulted in the misclassification of many sugarcane fields at those times as forests (Fig 1 a &b). This resulted in massive emissions from 2000 to 2011, as sugarcane harvests were mistaken for forest losses.

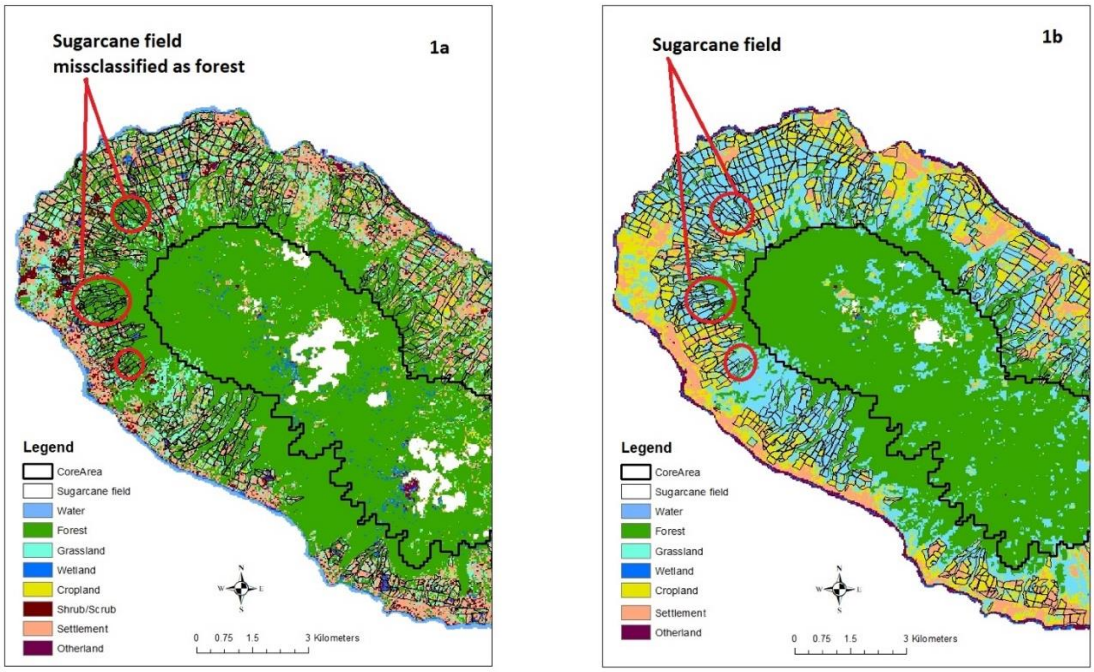


Figure 4-19. Sugarcane Fields Misclassified as Forest in 2000; Corrected Sugarcane Fields on right.

Newly released, recalibrated surface reflectance images (collection 2) from Landsat 7 and Landsat 8 images for the years 2000, 2005, 2011, 2014 and 2018 were used for reanalysis. It is hard to separate reflections from dense matured sugarcane fields with trees in mid-resolution Landsat satellite images. Therefore, normalised difference vegetation index (NDVI) was derived for each satellite image. The NDVI values were used to differentiate forests from sugarcane fields and grasslands. Land use classification models were built from training data collected from the land cover map from 2017, auxiliary data on abandoned past sugarcane fields and NDVI values for six IPCC land categories - Forest, Grassland, Cropland, Wetland, Settlement and Other land. All the training points were digitally collected, to train a random forest classification model. Using this model, land use maps were produced for the years 2000, 2005, 2011, 2014 and 2018, which were the years with least cloud covered satellite images for the country. Land use maps were verified digitally over high-resolution satellite images in the Google Earth Engine. Each land use pixel was then tracked from 2000 to 2018, to generate activity data for each of the 4 time periods: 2000-2005, 2005-2011, 2011-2014 and 2014-2018. The classification map for 2018 and land use change map for 2014-2018 were ground verified in addition to the digital verification for quality assurance. IPCC default emission factors were used to calculate GHG emission for all 4 time periods.

By spatially explicit tracking of land use changes pixels from 2000 to 2018, the GHGMI team was able to identify growth as well as loss of secondary forest following the abandonment of sugarcane fields. Emissions and removals of CO_2 from gains and losses of secondary forests, were calculated using IPCC default growth rates for emission factors. Activity data and total CO_2e emissions for the four time periods are presented in Table 4-11 and Table 4-12, as shown below and on next page.

Table 4-11. Activity data for four time periods between 2000 and 2018.

Land use category	2000-2005 (ha)	2005-2011 (ha)	2011-2014 (ha)	2014-2018 (ha)
Forest remaining Forest	7,241	6,628	6,609	6,490
Land converted to Forest	2,810	4,257	5,442	4,540
Grassland remaining Grassland	4,070	2,053	1,012	901
Land converted to Grassland	5,282	4,586	4,069	5,970
Cropland* remaining Cropland	1,505	735	630	625
Land converted to Cropland	2,259	3,828	4,994	4,462
Wetland remaining Wetland	188	173	103	87
Land converted to Wetland	142	172	134	229
Settlement remaining Settlement	1,737	1,251	889	746
Land converted to Settlement	662	2,167	2,021	1,990
Other land remaining Other land	468	399	301	263
Land converted to Other land	205	319	366	265
Total	**26,569**	**26,569**	**26,568**	**26,568**

* Croplands include agriculture fields and fallow lands.

Table 4-12. CO_2e Emissions (source) and Removals (sink) for 4 time periods between 2000 and 2018. Negative sign denotes CO_2e removal (sink).

Land use category	2000-2005 (tCO_2e)	2005-2011 (tCO_2e)	2011-2014 (tCO_2e)	2014-2018 (tCO_2e)
Forest remaining Forest	-232,313	-255,160	-127,217	-166,587
Land converted to Forest	-250,923	-524,932	-327,730	-394,783
Grassland remaining Grassland	0	0	0	0
Land converted to Grassland	211,902	125,018	92,262	54,902
Cropland remaining Cropland	0	0	0	0
Land converted to Cropland	27,862	98,951	67,741	41,310
Wetland remaining Wetland	0	0	0	0
Land converted to Wetland	469	0	426	0
Settlement remaining Settlement	0	0	0	0
Land converted to Settlement	2,699	20,330	9,400	3,008
Other land remaining Other land	0	0	0	0
Land converted to Other land	8,752	140,725	13,661	9,767
Total CO_2e Emissions	**-231,552**	**-395,067**	**-271,458**	**-452,383**
Annual CO_2e Emissions	**-46,310**	**-65,844**	**-90,486**	**-113,096**

Annual CO_2 removals (sink) increased from -46.3 kt CO_2e in 2000 to -113.1 kt CO_2e in 2018. In terms of the current inventory period 2008 – 2018, annual CO_2 removals (sink) increased from -65.8 kt CO_2e in 2008 to -113.1 kt CO_2e in 2018.

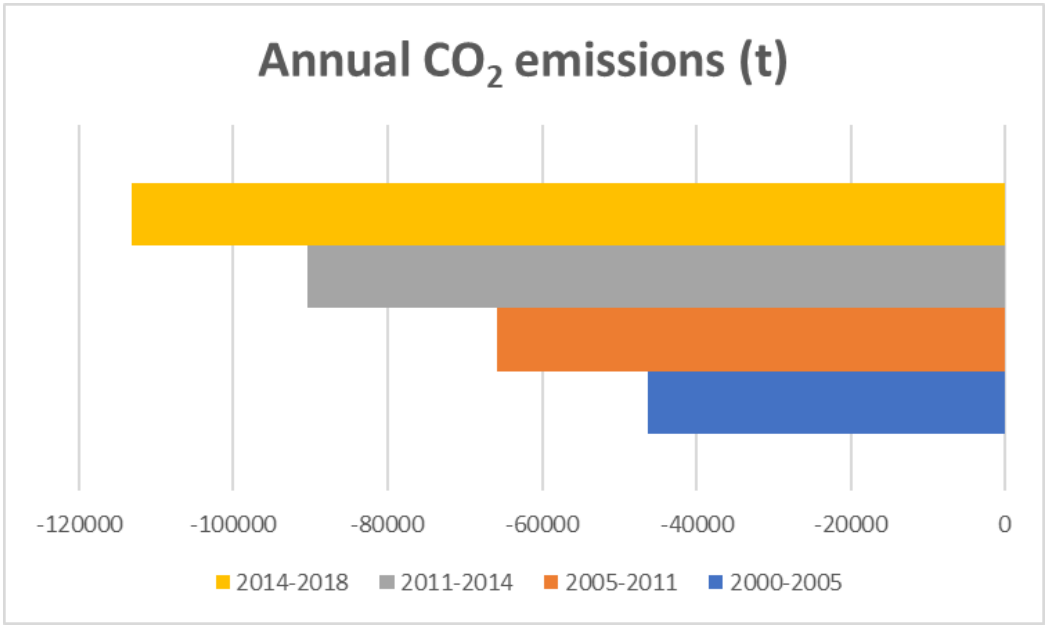


Figure 4-20. Annual CO_2e Removals (Sinks) for Four Time Periods Between 2000 and 2018.

4.7 Waste

Overview of the Waste Sector

The waste sector is the second (2nd) largest contributor to overall GHG emissions for St. Kitts and Nevis. In 2018, GHG emission estimates accounted for approximately 16.2% of overall CO_2 equivalent emissions (without considering LULUCF). Emissions from this sector arise from Solid Waste Disposal (78%), Domestic and Industrial wastewater treatment and discharge (approximately 22%) and Open Burning of waste (less than 1%)

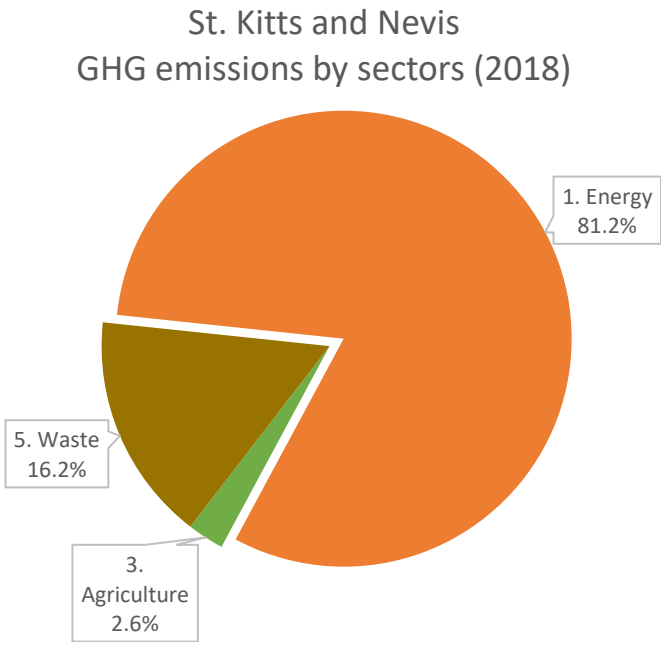


Figure 4-21. St. Kitts and Nevis GHG emissions (2018) by sector

GHG emissions in the waste sector typically come from sources related to the treatment of solid waste as well as the treatment and discharge of wastewater (industrial and domestic). In St. Kitts and Nevis, solid waste disposal and open burning of waste takes place with local experts indicating (based on national circumstance) that neither biological treatment of solid waste, nor large scale waste incineration occurs. Information on the disposal of hazardous and medical waste was not available for the reported timeseries but tonnage values of the aforementioned were included in the datasets provided by the Solid Waste Management Cooperation. Country specific information on open burning of waste and waste incineration is an identified area of improvement is highlighted in Section 4.10.

On this basis, GHG emission estimates for the gases CO_2, CH_4 and N_2O were compiled for the Waste Sector categories presented in Table 4.13 below.

Table 4-13- Reported IPCC Categories in the Waste Sector

IPCC Category	IPCC Category Name
4.A	Solid Waste Disposal
4.C.2	Open Burning of Waste
4.D.1	Domestic Wastewater Treatment and Discharge
4.D.2	Industrial Wastewater Treatment and Discharge

St. Kitts and Nevis did not calculate GHG emission estimates for the waste sector in their 2nd NC submission due to unavailability of data. During the current inventory cycle, GHG emission estimates were prepared for the timeseries 2000-2018 in an effort to revise previously submitted GHG inventories.

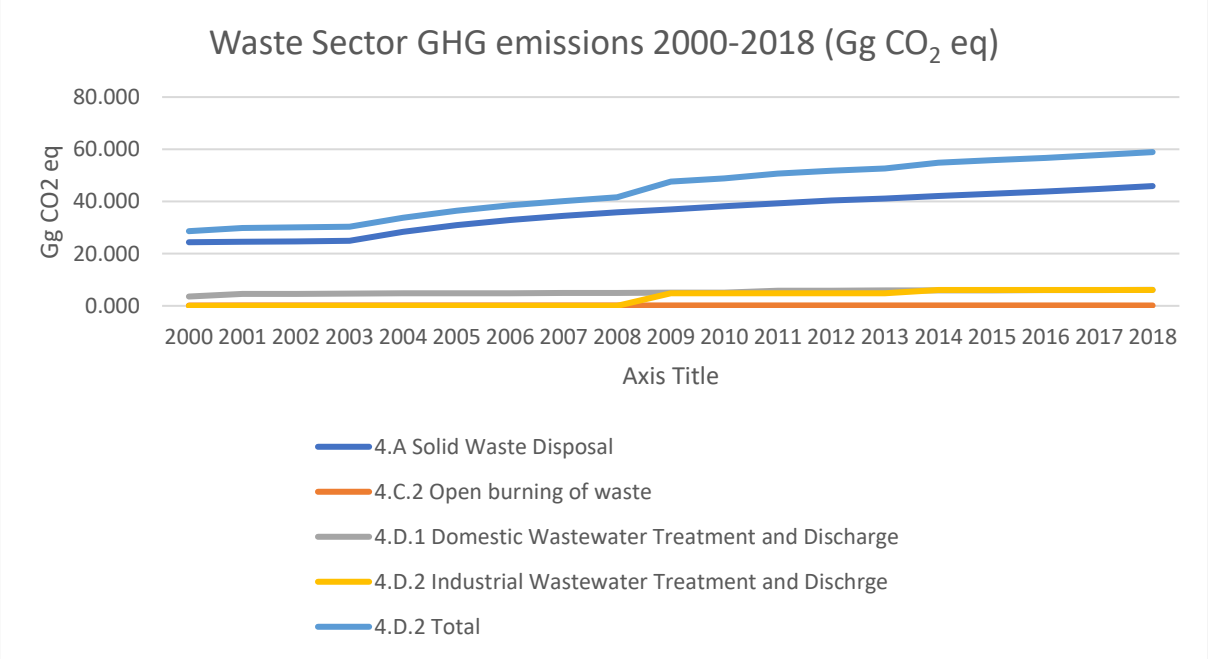


Figure 4-22. GHG emissions Trends 2000-2018 by IPCC Sub-category (Waste)

Total GHG emissions in the waste sector amounted to 28.623 Gg CO_2eq in the year 2000 and 58.918 Gg CO_2eq in the year 2018. This represents an increase of approximately 106%.

Solid Waste Disposal

It is important to note that solid waste disposal calculations relied heavily on the use of the IPCC defaults and input parameters reflective of the Latin America and Caribbean (LAC) region with current estimates reflective of the population increase over the timeseries as well as the change to the managed landfill categorisation from 2003 onwards.

In St. Kitts and Nevis, industrial waste is sent to Solid Waste Disposal Sites (SWDS) along with Municipal Solid Waste. Discussions and guidance from local experts indicated that industrial waste totals were small in comparison to total waste tonnage. Given that country GDP is one of the main input parameters when using the Tier 1 FOD model for calculating Industrial Solid Waste emissions, local experts did not believe that this methodology was reflective of national circumstance as St. Kitts and Nevis GDP is heavily reliant on the Tourism industry. Estimates for Solid Waste Disposal were not included for the timeseries and have its inclusion highlighted as an improvement suggestion.

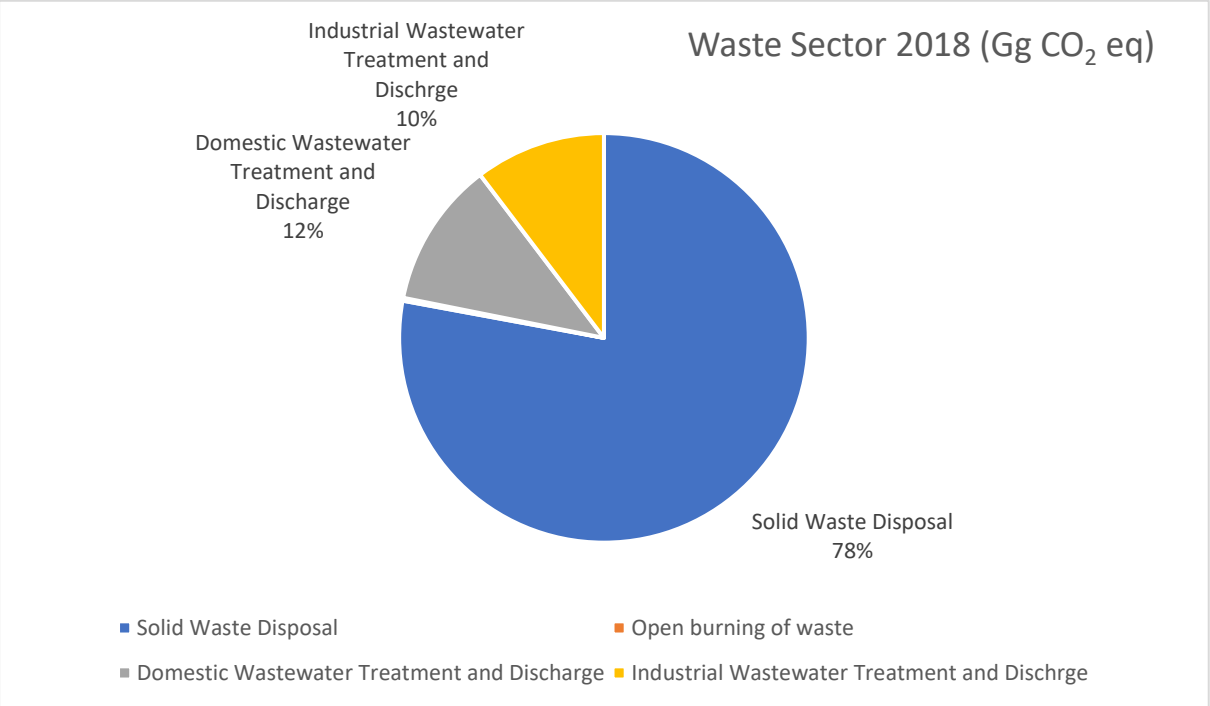


Figure 4-23. 2018 Waste Sector (Sub-category Profile) PLEASE NOTE, THERE IS NO ORANGE SECTION IN THE FIGURE HERE, THOUGH ONE IS INDICATED IN THE LEGEND.

In 2018, the majority of GHG emission from the waste sector occur during solid waste disposal (78%) with wastewater treatment and discharge accounting for less than 22% and Open Burning of waste less than 1%.

Open Burning

Information provided by local experts indicated open burning of waste did occur, however no information was available. Expert judgement on the percentage of population that open burns was used and the category included (under 1%) in adherence with the TACCC principles and completeness of the GHG inventory.

Wastewater Treatment and Discharge (Domestic and Industrial)

Domestic Wastewater Treatment and Discharge accounted for less than 12% of waste sector emissions in 2018. No country specific information was available on urbanisation values and degradable organic component (BOD) with international sources and IPCC defaults used. Information on types of treatment/discharge pathways was available for the St. Kitts and Nevis population from 1990 onwards and are incorporated in the calculation estimates.

Industrial Wastewater Treatment and Discharge estimates were calculated for the timeseries 2009-2018 due to availability of data from the local brewery. Efforts were made to extend the timeseries but were not included due to the need to validate wastewater values for the period 2000-2008. It should be noted that this omission does affect the 106% increase in overall sectoral emissions between 2000-2018. Inclusion of GHG emissions reported under the sub-category industrial wastewater for the period 2000-2008 is expected during the next inventory reporting cycle upon receipt and validation of the missing dataset.

CH_4 dominates the waste sector with 98.45% in 2008 and 98.82% in 2018. N_2O contributes only 1.48% in 2008 and 1.13% in 2018 with CO_2 contributing 0.07% in 2008 and 0.05% in 2018.

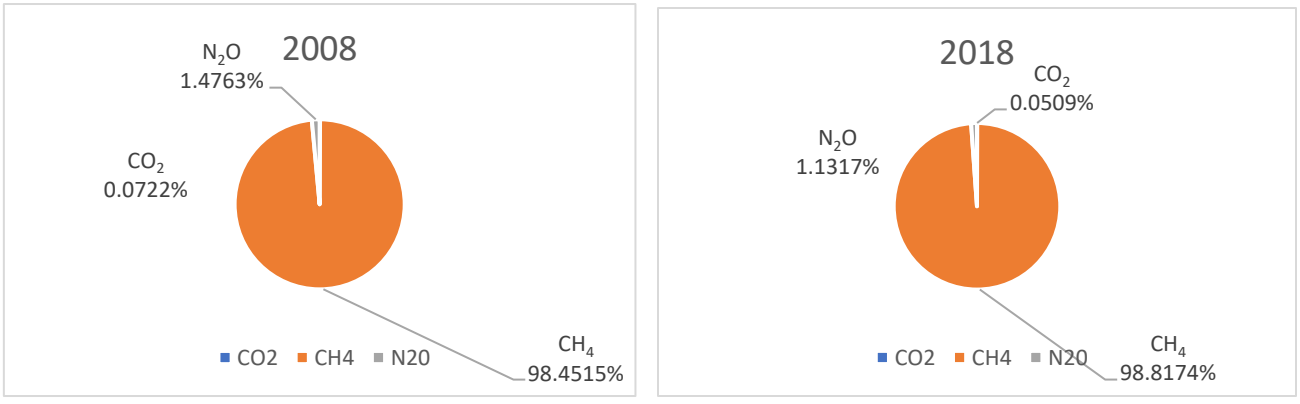


Figure 4-24. Share of Gases- Waste Sector (2008 and 2018)

Table 4-13. GHG emissions (Gg CO_2 eq) in the Waste Sector (2008-2018)

IPCC Category	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
4. Waste	41.55	47.59	48.85	50.71	51.81	52.61	54.84	55.81	56.66	57.76	58.92
4.A. Solid Waste	35.85	36.97	38.18	39.31	40.35	41.09	42.04	42.96	43.76	44.80	45.90
4.B Biological treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C. Incineration and open burning of	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14
4.D. Wastewater treatment and	5.58	10.50	10.54	11.27	11.33	11.39	12.66	12.72	12.77	12.83	12.88

4.8 GHG emission tables

Table 4-14. IPCC Short Summary Table (2018)

	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	292,29	2,30	0,03	NE	NE	NE	NE	NO	NE,NO	NE, NO	NE,NO	NE,NO
1 - Energy	292,26	0,02	0,01	NA	NA	NA	NA	NA	NE,NO	NE, NO	NE,NO	NE,NO
1.A - Fuel Combustion Activities	292,25	0,02	0,01						NE	NE	NE	NE
1.B - Fugitive emissions from fuels	0,00	NO	NO						NE	NE	NE	NE
1.C - Carbon dioxide Transport and Storage	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	0,00	0,00	0,00	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NE, NO	NE,NO	NE,NO
2.A - Mineral Industry	NO								NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NA	NA	NA	NA	NO	NO	NO	NO	NO
2.C - Metal Industry	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE	NA	NA						NE	NE	NE	NE
2.E - Electronics Industry				NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00
2.F - Product Uses as Substitutes for Ozone Depleting Substances				NE	NE			NO	0,00	0,00	0,00	0,00
2.G - Other Product Manufacture and Use	NA	NA	NE	NO	NO	NE	NO	NO	NE	NE	NE	NE
2.H - Other	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	0,01	0,21	0,01	NA	NA	NA	NA	NA	NE,NO	NE, NO	NE,NO	NE,NO
3.A - Livestock		0,21	0,00						NE	NE	NE	NE
3.B - Land	0,00		0,00						0,00	0,00	0,00	0,00
3.C - Aggregate sources and non-CO2 emissions sources on land	0,01	0,00	0,01						0,00	0,00	0,00	0,00
3.D - Other	NE	NA	NA						NO; NE	NO; NE	NO; NE	NO; NE
4 - Waste	0,03	2,08	0,00	NA	NA	NA	NA	NA	NE,NO	NE, NO	NE,NO	NE,NO
4.A - Solid Waste Disposal		1,64							NE	NE	NE	
4.B - Biological Treatment of Solid Waste		0,00	0,00						NO	NO	NO	
4.C - Incineration and Open Burning of Waste	0,03	0,00	0,00						NE	NE	NE	NE

	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
4.D - Wastewater Treatment and Discharge		0,44	0,00						NE	NE	NE	
4.E - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
5 - Other	NO	NO	NE,NO	NO	NO	NO	NO	NO	NE,NO	NE, NO	NE,NO	NE,NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3			NE						NE	NE	NE	NE
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	NE,IE	NE,IE	NE,IE	NA	NA	NA	NA	NA	NE,NE	NE, NE	NE,NE	NE,NE
1.A.3.a.i - International Aviation (International Bunkers)	NE	NE	NE						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	NO,IE	NO,IE	NO,IE						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	NO	NO	NO						NO	NO	NO	NO

Table 4-15. IPCC Summary Table (2018)

	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	292,29	2,30	0,03	NE	NE	NE	NE	NO	NE	NE	NE	NE
1 - Energy	292,26	0,02	0,01	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A - Fuel Combustion Activities	292,25	0,02	0,01	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.1 - Energy Industries	181,15	0,01	0,00						NE	NE	NE	NE
1.A.2 - Manufacturing Industries and Construction	5,900	0,00 02	5E-05						NE	NE	NE	NE
1.A.3 - Transport	98,17	0,01	0,01						NE	NE	NE	NE
1.A.4 - Other Sectors	7,04	0,00	0,00						NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO						NO	NO	NO	NO
1.B - Fugitive emissions from fuels	0,0023	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.B.1 - Solid Fuels	NO	NO	NA						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	0,0023	NO	NO						NO	NO	NO	NO
1.B.3 - Other emissions from Energy Production	NO	NO	NO						NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	NE	NO	NE	NE	NE	NE	NE	NA	0	0	0	0
2.A - Mineral Industry	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.1 - Cement production	NO								NO	NO	NO	NO
2.A.2 - Lime production	NO								NO	NO	NO	NO
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NA	NA	NA	NA	NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO

	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMV OCs	SO_2
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO							NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	0	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	0	NO	NO	NO	0	NO	NO	NO	NO
2.C - Metal Industry	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	NO	NO			NO				NO	NO	NO	NO
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminum production	NO				NO	NO		0	NO	NO	NO	NO
2.C.4 - Magnesium production	NO				NO	NO		0	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	0	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE								NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE								NO	NO	NO	NO
2.D.3 - Solvent Use									NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.E - Electronics Industry	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	0
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	0
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	0
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	0
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	NE	NE	NO	NE	0	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				NE				NO	NO	NO	NO	0
2.F.2 - Foam Blowing Agents				NE				NO	NO	NO	NO	0
2.F.3 - Fire Protection				NE	NE			NO	NO	NO	NO	0
2.F.4 - Aerosols				NE				NO	NO	NO	NO	0
2.F.5 - Solvents				NE	NE			NO	NO	NO	NO	0
2.F.6 - Other Applications (please specify)				NE	NE			NO	NO	NO	NO	0
2.G - Other Product Manufacture and Use	NA	NA	NE	NO	NO	NE	NO	0	0	0	0	0
2.G.1 - Electrical Equipment					NO	NE		NO	NO	NO	NO	NO

	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMV OCs	SO_2
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NO		NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NE						NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	0	0	NO	NO	NO	NO	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO							NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO							NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-113,09	0,21	0,01	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A - Livestock	NA	0,2072	0,003	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.1 - Enteric Fermentation		0,18							NO	NO	NO	NO
3.A.2 - Manure Management		0,02	0,00						NO	NO	NO	NO
3.B - Land	-113,10	0	0	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	-140,34								NO	NO	NO	NO
3.B.2 - Cropland	10,33								NO	NO	NO	NO
3.B.3 - Grassland	13,73								NO	NO	NO	NO
3.B.4 - Wetlands	0,00		0,00						NO	NO	NO	NO
3.B.5 - Settlements	0,75								NO	NO	NO	NO
3.B.6 - Other Land	2,44								NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	0,01	0,00	0,01	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.1 - Emissions from biomass burning		0,00	0,00						NO	NO	NO	NO
3.C.2 - Liming	NE								NO	NO	NO	NO
3.C.3 - Urea application	0,01								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0,01						NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils			0,00						NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			0,00						NO	NO	NO	NO
3.C.7 - Rice cultivation		NO							NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other	0	0	0	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NE								NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
4 - Waste	0,03	2,08	0,00	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.A - Solid Waste Disposal	0,00	1,64		NA	NA	NA	NA	NA	NE	NE	NE	NA

	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMV OCs	SO_2
4.B - Biological Treatment of Solid Waste		0,00	0,00	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.C - Incineration and Open Burning of Waste	0,00	0,00	0,00	NA	NA	NA	NA	NA	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge		0,44	0,00	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NE	NE	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NE	NE	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	NE,IE	NE,IE	NE,IE	NA	NA	NA	NA	NA	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	NE	NE	NE						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	NO,IE	NO,IE	NO,IE						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE

Table 4-16. IPCC Energy Sectoral Table (2018)

	Emissions (Gg)						
Categories	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
1 - Energy	292,26	0,02	0,01	NE	NE	NE	NE
1.A - Fuel Combustion Activities	292,25	0,02	0,01	NE	NE	NE	NE
1.A.1 - Energy Industries	181,15	0,01	0,00	NE	NE	NE	NE
1.A.1.a - Main Activity Electricity and Heat Production	181,15	0,01	0,00	NE	NE	NE	NE
1.A.1.a.i - Electricity Generation	181,15	0,01	0,00	NE	NE	NE	NE
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	NO	NO	NO	NO	NO	NO	NO
1.A.1.a.iii - Heat Plants	NO	NO	NO	NO	NO	NO	NO
1.A.1.b - Petroleum Refining	NO	NO	NO	NO	NO	NO	NO
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	NE	NE	NE	NE	NE	NE	NE
1.A.1.c.i - Manufacture of Solid Fuels	NE	NE	NE	NE	NE	NE	NE
1.A.1.c.ii - Other Energy Industries	NO	NO	NO	NO	NO	NO	NO
1.A.2 - Manufacturing Industries and Construction	5,900399	0,000239	4,78E-05	NE	NE	NE	NE
1.A.2.a - Iron and Steel	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.b - Non-Ferrous Metals	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.c - Chemicals	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.d - Pulp, Paper and Print	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.e - Food Processing, Beverages and Tobacco	0,15	0,00	0,00	NE	NE	NE	NE
1.A.2.f - Non-Metallic Minerals	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.g - Transport Equipment	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.h - Machinery	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.i - Mining (excluding fuels) and Quarrying	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.j - Wood and wood products	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.k - Construction	5,75	0,00	0,00	NO	NO	NO	NO
1.A.2.l - Textile and Leather	0,00	0,00	0,00	NO	NO	NO	NO
1.A.2.m - Non-specified Industry	0,00	0,00	0,00	NO	NO	NO	NO
1.A.3 - Transport	98,17	0,01	0,01	NE	NE	NE	NE
1.A.3.a - Civil Aviation	NE	NE	NE	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers) (1)	NE	NE	NE	NE	NE	NE	NE
1.A.3.a.ii - Domestic Aviation	NE	NE	NE	NE	NE	NE	NE
1.A.3.b - Road Transportation	98,00	0,01	0,01	NE	NE	NE	NE
1.A.3.b.i - Cars	61,82	0,01	0,01	NE	NE	NE	NE
1.A.3.b.i.1 - Passenger cars with 3-way catalysts	61,77	0,01	0,01	NE	NE	NE	NE
1.A.3.b.i.2 - Passenger cars without 3-way catalysts	0,05	0,00	0,00	NE	NE	NE	NE
1.A.3.b.ii - Light-duty trucks	12,36	0,00	0,00	NE	NE	NE	NE
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts	11,07	0,00	0,00	NE	NE	NE	NE

Categories	Emissions (Gg)						
	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts	1,28	0,00	0,00	NE	NE	NE	NE
1.A.3.b.iii - Heavy-duty trucks and buses	23,66	0,00	0,00	NE	NE	NE	NE
1.A.3.b.iv - Motorcycles	0,16	0,00	0,00	NE	NE	NE	NE
1.A.3.b.v - Evaporative emissions from vehicles	NE	NE	NE	NE	NE	NE	NE
1.A.3.b.vi - Urea-based catalysts	IE	IE	IE	NE	NE	NE	NE
1.A.3.c - Railways	0,17	0,00	0,00	NE	NE	NE	NE
1.A.3.d - Water-borne Navigation	NE	NE	NE	NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers) (1)	NO,IE	NO,IE	NO,IE	NO,NE	NO,NE	NO,NE	NO,NE
1.A.3.d.ii - Domestic Water-borne Navigation	NE	NE	NE	NE	NE	NE	NE
1.A.3.e - Other Transportation	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
1.A.3.e.i - Pipeline Transport	NO	NO	NO	NO	NO	NO	NO
1.A.3.e.ii - Off-road	NE	NE	NE	NE	NE	NE	NE
1.A.4 - Other Sectors	7,04	0,00	0,00	NE	NE	NE	NE
1.A.4.a - Commercial/Institutional	2,13	0,00	0,00	NE	NE	NE	NE
1.A.4.b - Residential	4,57	0,00	0,00	NE	NE	NE	NE
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	0,34	0,00	0,00	NE	NE	NE	NE
1.A.4.c.i - Stationary	0,34	0,00	0,00	NE	NE	NE	NE
1.A.4.c.ii - Off-road Vehicles and Other Machinery	NE	NE	NE	NE	NE	NE	NE
1.A.4.c.iii - Fishing (mobile combustion)	NE	NE	NE	NE	NE	NE	NE
1.A.5 - Non-Specified	NO	NO	NO	NO	NO	NO	NO
1.A.5.a - Stationary	NO	NO	NO	NO	NO	NO	NO
1.A.5.b - Mobile	NO	NO	NO	NO	NO	NO	NO
1.A.5.b.i - Mobile (aviation component)	NO	NO	NO	NO	NO	NO	NO
1.A.5.b.ii - Mobile (water-borne component)	NO	NO	NO	NO	NO	NO	NO
1.A.5.b.iii - Mobile (Other)	NO	NO	NO	NO	NO	NO	NO
1.A.5.c - Multilateral Operations (1)(2)	NO	NO	NO	NO	NO	NO	NO
1.B - Fugitive emissions from fuels	0,002288	NO	NO	NO	NO	NO	NO
1.B.1 - Solid Fuels	NO	NO	NA	NO	NO	NO	NO
1.B.1.a - Coal mining and handling	NO	NO		NO	NO	NO	NO
1.B.1.a.i - Underground mines	NO	NO		NO	NO	NO	NO
1.B.1.a.i.1 - Mining	NO	NO		NO	NO	NO	NO
1.B.1.a.i.2 - Post-mining seam gas emissions	NO	NO		NO	NO	NO	NO
1.B.1.a.i.3 - Abandoned underground mines	NO	NO		NO	NO	NO	NO
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	NO	NO		NO	NO	NO	NO
1.B.1.a.ii - Surface mines	0	0		0	0	0	0
1.B.1.a.ii.1 - Mining	NO	NO		NO	NO	NO	NO
1.B.1.a.ii.2 - Post-mining seam gas emissions	NO	NO		NO	NO	NO	NO
1.B.1.b - Uncontrolled combustion and burning coal dumps	NO	NO		NO	NO	NO	NO
1.B.1.c - Solid fuel transformation	NE	NE	NE	NE	NE	NE	NE

	Emissions (Gg)						
Categories	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
1.B.2 - Oil and Natural Gas	0,002288	NO	NO	NO	NO	NO	NO
1.B.2.a - Oil	0,00	NO	NO	NO	NO	NO	NO
1.B.2.a.i - Venting	NO	NO		NO	NO	NO	NO
1.B.2.a.ii - Flaring	NO	NO	NO	NO	NO	NO	NO
1.B.2.a.iii - All Other	0,00	0,00	NO	NO	NO	NO	NO
1.B.2.a.iii.1 - Exploration	NO	NO		NO	NO	NO	NO
1.B.2.a.iii.2 - Production and Upgrading	NO	NO	NO	NO	NO	NO	NO
1.B.2.a.iii.3 - Transport	0,00	NO	NO	NO	NO	NO	NO
1.B.2.a.iii.4 - Refining	NO	NO		NO	NO	NO	NO
1.B.2.a.iii.5 - Distribution of oil products	NO	NO		NO	NO	NO	NO
1.B.2.a.iii.6 - Other	NO	NO	NO	NO	NO	NO	NO
1.B.2.b - Natural Gas	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.i - Venting	NO	0,00		NO	NO	NO	NO
1.B.2.b.ii - Flaring	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii - All Other	NO	NO	NO	NO	NO	NO	NO
1.B.2.b.iii.1 - Exploration	NO	NO		NO	NO	NO	NO
1.B.2.b.iii.2 - Production	NO	NO		NO	NO	NO	NO
1.B.2.b.iii.3 - Processing	NO	NO		NO	NO	NO	NO
1.B.2.b.iii.4 - Transmission and Storage	NO	NO		NO	NO	NO	NO
1.B.2.b.iii.5 - Distribution	NO	NO		NO	NO	NO	NO
1.B.2.b.iii.6 - Other	NO	NO	NO	NO	NO	NO	NO
1.B.3 - Other emissions from Energy Production	NO	NO	NO	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO			NO	NO	NO	NO
1.C.1.a - Pipelines	NO			NO	NO	NO	NO
1.C.1.b - Ships	NO			NO	NO	NO	NO
1.C.1.c - Other (please specify)	NO			NO	NO	NO	NO
1.C.2 - Injection and Storage	NO			NO	NO	NO	NO
1.C.2.a - Injection	NO			NO	NO	NO	NO
1.C.2.b - Storage	NO			NO	NO	NO	NO
1.C.3 - Other	NO	NO		NO	NO	NO	NO

	Emissions (Gg)						
Categories	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
Memo Items (3)							
International Bunkers	NE,IE	NE,IE	NE,IE	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers) (1)	NE	NE	NE	NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers) (1)	NO,IE	NO,IE	NO,IE	NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)	NO	NO	NO	NE	NE	NE	NE

	Emissions (Gg)						
Categories	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
Information Items							
CO2 from Biomass Combustion for Energy Production	0,17						

Table 4-17. IPCC Sectoral Table – IPPU (2018)

Categories	(Gg)			CO_2 Equivalents(Gg)				(Gg)				
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO2 equivalent conversion factors (1)	Other halogenated gases without CO2 equivalent conversion factors (2)	NOx	CO	NMVOCs	SO_2
2 - Industrial Processes and Product Use	NE	NO	NE	NE	NE	NE	NE	0	0	0	0	0
2.A - Mineral Industry	NO	NA	NA	NA	NA	NA	NA	0	0	0	0	0
2.A.1 - Cement production	NO								0	0	0	0
2.A.2 - Lime production	NO								0	0	0	0
2.A.3 - Glass Production	NO								0	0	0	0
2.A.4 - Other Process Uses of Carbonates	NO	NA	NA	NA	NA	NA	NA	0	0	0	0	0
2.A.4.a - Ceramics	NO								0	0	0	0
2.A.4.b - Other Uses of Soda Ash	NO								0	0	0	0
2.A.4.c - Non-Metallurgical Magnesia Production	NO								0	0	0	0
2.A.4.d - Other (please specify) (3)	NO								0	0	0	0
2.A.5 - Other (please specify) (3)									0	0	0	0
2.B - Chemical Industry	NO	NO	NO	NA	NA	NA	NA	0	0	0	0	0
2.B.1 - Ammonia Production	NO								0	0	0	0
2.B.2 - Nitric Acid Production			NO						0	0	0	0
2.B.3 - Adipic Acid Production			NO						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						0	0	0	0
2.B.5 - Carbide Production	NO	NO							0	0	0	0
2.B.6 - Titanium Dioxide Production	NO								0	0	0	0
2.B.7 - Soda Ash Production	NO								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	0	0	0	0	0
2.B.8.a - Methanol	NO	NO							0	0	0	0
2.B.8.b - Ethylene	NO	NO							0	0	0	0
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	NO	NO							0	0	0	0
2.B.8.d - Ethylene Oxide	NO	NO							0	0	0	0
2.B.8.e - Acrylonitrile	NO	NO							0	0	0	0
2.B.8.f - Carbon Black	NO	NO							0	0	0	0
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	0	0	0	0	0
2.B.9.a - By-product emissions (4)					NO	NO	NO	0	0	0	0	0
2.B.9.b - Fugitive Emissions (4)					NO	NO	NO		0	0	0	0

Categories	(Gg)			CO_2 Equivalents(Gg)				(Gg)				
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO2 equivalent conversion factors (1)	Other halogenated gases without CO2 equivalent conversion factors (2)	NOx	CO	NMVOCs	SO_2
2.B.10 - Other (Please specify) (3)					NO	NO	NO		0	0	0	0
2.C - Metal Industry	NO	NO	NA	NO	NO	NO	NO	0	0	0	0	0
2.C.1 - Iron and Steel Production	NO	NO			NO	NO			0	0	0	0
2.C.2 - Ferroalloys Production	NO	NO							0	0	0	0
2.C.3 - Aluminum production	NO				NO	NO		0	0	0	0	0
2.C.4 - Magnesium production (5)	NO			NO	NO	NO	NO	0	0	0	0	0
2.C.5 - Lead Production	NO								0	0	0	0
2.C.6 - Zinc Production	NO								0	0	0	0
2.C.7 - Other (please specify) (3)									0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use (6)	NE	NA	NA	NA	NA	NA	NA	0	0	0	0	0
2.D.1 - Lubricant Use	NE								0	0	0	0
2.D.2 - Paraffin Wax Use	NE								0	0	0	0
2.D.3 - Solvent Use (7)									0	0	0	0
2.D.4 - Other (please specify) (3), (8)									0	0	0	0
2.E - Electronics Industry	NA	NA	NA	NO	NO	NO	NO	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor (9)				NO	NO	NO	NO	0	0	0	0	0
2.E.2 - TFT Flat Panel Display (9)				NO	NO	NO	NO	0	0	0	0	0
2.E.3 - Photovoltaics (9)				NO	NO	NO	NO	0	0	0	0	0
2.E.4 - Heat Transfer Fluid (10)				NO	NO	NO	NO	0	0	0	0	0
2.E.5 - Other (please specify) (3)				NO	NO	NO	NO		0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	NE	NE	NO	NE	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	NE	NE	NO	NE	0	0	0	0	0
2.F.1.a - Refrigeration and Stationary Air Conditioning				NE	NE	NO	NE	0	0	0	0	0
2.F.1.b - Mobile Air Conditioning				NE	NE	NO	NE	0	0	0	0	0
2.F.2 - Foam Blowing Agents				NE	NE	NO	NE	0	0	0	0	0
2.F.3 - Fire Protection				NE	NE	NO	NE	0	0	0	0	0
2.F.4 - Aerosols				NE	NE	NO	NE	0	0	0	0	0
2.F.5 - Solvents				NE	NE	NO	NE	0	0	0	0	0
2.F.6 - Other Applications (please specify) (3)				NE	NE	NO	NE	0	0	0	0	0
2.G - Other Product Manufacture and Use	NA	NA	NE	NO	NO	NE	NO	0	0	0	0	0

Categories	(Gg)			CO_2 Equivalents(Gg)				(Gg)				
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO2 equivalent conversion factors (1)	Other halogenated gases without CO2 equivalent conversion factors (2)	NOx	CO	NMVOCs	SO_2
2.G.1 - Electrical Equipment	NA	NA	NA	NO	NO	NE	NO	0	0	0	0	0
2.G.1.a - Manufacture of Electrical Equipment				NO	NO	NE	NO	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment				NO	NO	NE	NO	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment				NO	NO	NE	NO	0	0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NO	NO	NO	0	0	0	0	0
2.G.2.a - Military Applications					NO	NO	NO	0	0	0	0	0
2.G.2.b - Accelerators					NO	NO	NO	0	0	0	0	0
2.G.2.c - Other (please specify) (3)					NO	NO	NO	0	0	0	0	0
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	0	0	0	0	0
2.G.3.a - Medical Applications			NE						0	0	0	0
2.G.3.b - Propellant for pressure and aerosol products			NE						0	0	0	0
2.G.3.c - Other (Please specify) (3)			NO						0	0	0	0
2.G.4 - Other (Please specify) (3)									0	0	0	0
2.H - Other	NO	NO	NO	NO	NO	NO	NO	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	NO	NO	NO	NO	NO	NO	NO		0	0	0	0
2.H.2 - Food and Beverages Industry	NO	NO	NO	NO	NO	NO	NO		0	0	0	0
2.H.3 - Other (please specify) (3)	NO	NO	NO	NO	NO	NO	NO		0	0	0	0

Table 4-18. IPCC Sectoral Table – AFOLU (2018)

Categories	(Gg)					
	Net CO_2 emissions / removals	Emissions				
		CH_4	N_2O	NOx	CO	NMVOCs
3 - Agriculture, Forestry, and Other Land Use	-113,09	0,21	0,01	NE	NA	NE
3.A - Livestock	NA	0,21	0,00	NA	NA	NE
3.A.1 - Enteric Fermentation	NA	0,18	NA	NA	NA	NA
3.A.1.a - Cattle	NA	0,13	NA	NA	NA	NA
3.A.1.a.i - Dairy Cows		0,07				
3.A.1.a.ii - Other Cattle		0,06				
3.A.1.b - Buffalo		NO				
3.A.1.c - Sheep		0,03				
3.A.1.d - Goats		0,02				
3.A.1.e - Camels		NO				
3.A.1.f - Horses		NE				
3.A.1.g - Mules and Asses		0				
3.A.1.h - Swine		0,01				
3.A.1.j - Other (please specify)		NO				
3.A.2 - Manure Management (1)	NA	0,02258302	0,002983017	NA	NA	NE
3.A.2.a - Cattle	NA	0,00	0,00	NA	NA	NE
3.A.2.a.i - Dairy cows		0,00	0,00			NE
3.A.2.a.ii - Other cattle		0,00	0,00			NE
3.A.2.b - Buffalo		NO	NO			NO
3.A.2.c - Sheep		0,00	0,00			NE
3.A.2.d - Goats		0,00	0,00			NE
3.A.2.e - Camels		NO	NO			NO
3.A.2.f - Horses		NE	NE			NE
3.A.2.g - Mules and Asses		0	0			NE
3.A.2.h - Swine		0,02	0,00			NE
3.A.2.i - Poultry		0,00	0,00			NE
3.A.2.j - Other (please specify)		NO	NO			NE
3.B - Land	-113,10	NA	0,00	NO	NO	NO
3.B.1 - Forest land	-140,34	NA	NA	NO	NO	NO
3.B.1.a - Forest land remaining Forest land	-41,65			NO	NO	NO
3.B.1.b - Land converted to Forest land	-98,70	NA	NA	NO	NO	NO
3.B.1.b.i - Cropland converted to Forest Land	0,00			NO	NO	NO
3.B.1.b.ii - Grassland converted to Forest Land	0,00			NO	NO	NO
3.B.1.b.iii - Wetlands converted to Forest Land	0,00			NO	NO	NO
3.B.1.b.iv - Settlements converted to Forest Land	0,00			NO	NO	NO

Categories	(Gg)					
	Net CO_2 emissions / removals	Emissions				
		CH_4	N_2O	NOx	CO	NMVOCs
3.B.1.b.v - Other Land converted to Forest Land	0,00			NO	NO	NO
3.B.2 - Cropland	10,33	NA	NA	NO	NO	NO
3.B.2.a - Cropland remaining Cropland	0,00			NO	NO	NO
3.B.2.b - Land converted to Cropland	10,33	NA	NA	NO	NO	NO
3.B.2.b.i - Forest Land converted to Cropland	0,00			NO	NO	NO
3.B.2.b.ii - Grassland converted to Cropland	0,00			NO	NO	NO
3.B.2.b.iii - Wetlands converted to Cropland	0,00			NO	NO	NO
3.B.2.b.iv - Settlements converted to Cropland	0,00			NO	NO	NO
3.B.2.b.v - Other Land converted to Cropland	0,00			NO	NO	NO
3.B.3 - Grassland	13,73	NA	NA	NO	NO	NO
3.B.3.a - Grassland remaining Grassland	0,00			NO	NO	NO
3.B.3.b - Land converted to Grassland	13,73	NA	NA	NO	NO	NO
3.B.3.b.i - Forest Land converted to Grassland	0,00			NO	NO	NO
3.B.3.b.ii - Cropland converted to Grassland	0,00			NO	NO	NO
3.B.3.b.iii - Wetlands converted to Grassland	0,00			NO	NO	NO
3.B.3.b.iv - Settlements converted to Grassland	0,00			NO	NO	NO
3.B.3.b.v - Other Land converted to Grassland	0,00			NO	NO	NO
3.B.4 - Wetlands	0,00	NA	0	NO	NO	NO
3.B.4.a - Wetlands remaining Wetlands	0,00	NA	0,00	NO	NO	NO
3.B.4.a.i - Peatlands remaining peatlands	0,00		0	NO	NO	NO
3.B.4.a.ii - Flooded land remaining flooded land				NO	NO	NO
3.B.4.b - Land converted to Wetlands	0,00	NA	0,00	NO	NO	NO
3.B.4.b.i - Land converted for peat extraction			0	NO	NO	NO
3.B.4.b.ii - Land converted to flooded land	0,00			NO	NO	NO
3.B.4.b.iii - Land converted to other wetlands				NO	NO	NO
3.B.5 - Settlements	0,75	NA	NA	NO	NO	NO
3.B.5.a - Settlements remaining Settlements	0,00			NO	NO	NO
3.B.5.b - Land converted to Settlements	0,75	NA	NA	NO	NO	NO
3.B.5.b.i - Forest Land converted to Settlements	0,00			NO	NO	NO
3.B.5.b.ii - Cropland converted to Settlements	0,00			NO	NO	NO
3.B.5.b.iii - Grassland converted to Settlements	0,00			NO	NO	NO
3.B.5.b.iv - Wetlands converted to Settlements	0,00			NO	NO	NO

Categories	(Gg)					
	Net CO_2 emissions / removals	Emissions				
		CH_4	N_2O	NOx	CO	NMVOCs
3.B.5.b.v - Other Land converted to Settlements	0,00			NO	NO	NO
3.B.6 - Other Land	2,44	NA	NA	NO	NO	NO
3.B.6.a - Other Land remaining Other land				NO	NO	NO
3.B.6.b - Land converted to Other land	2,44	NA	NA	NO	NO	NO
3.B.6.b.i - Forest Land converted to Other Land	0,00			NO	NO	NO
3.B.6.b.ii - Cropland converted to Other Land	0,00			NO	NO	NO
3.B.6.b.iii - Grassland converted to Other Land	0,00			NO	NO	NO
3.B.6.b.iv - Wetlands converted to Other Land	0,00			NO	NO	NO
3.B.6.b.v - Settlements converted to Other Land	0,00			NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land (2)	0,01	0,00	0,01	NE	NO,NA	NE
3.C.1 - Emissions from biomass burning	NA	0,00	0,00	NA	NA	NE
3.C.1.a - Biomass burning in forest lands		0,00	0,00			NE
3.C.1.b - Biomass burning in croplands		0,00	0,00			NE
3.C.1.c - Biomass burning in grasslands		0,00	0,00			NE
3.C.1.d - Biomass burning in all other land		0,00	0,00			NE
3.C.2 - Liming	NE			NO	NO	NO
3.C.3 - Urea application	0,01			NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils (3)			0,01	NE	NA	NE
3.C.5 - Indirect N2O Emissions from managed soils			0,00	NE	NA	NE
3.C.6 - Indirect N2O Emissions from manure management			0,00	NO	NO	NO
3.C.7 - Rice cultivation		NO		NO	NO	NO
3.C.8 - Other (please specify)				NO	NO	NO
3.D - Other	NE	NA	NA	NO	NO	NO
3.D.1 - Harvested Wood Products	NE			NO	NO	NO
3.D.2 - Other (please specify)				NO	NO	NO

Table 4-19. IPCC Sectoral Table – Waste (2018)

Categories	Emissions [Gg]						
	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
4 - Waste	0,03	2,08	0,00	NE	NE	NE	NE
4.A - Solid Waste Disposal	0,00	1,64	NA	NE	NE	NE	
4.A.1 - Managed Waste Disposal Sites	0,00	1,64		NE	NE	NE	
4.A.2 - Unmanaged Waste Disposal Sites	0,00	0,00		NE	NE	NE	
4.A.3 - Uncategorised Waste Disposal Sites	0,00	0,00		NE	NE	NE	
4.B - Biological Treatment of Solid Waste		0	0	NA	NA	NA	
4.C - Incineration and Open Burning of Waste	0,03	0,00	0,00	NE	NE	NE	NE
4.C.1 - Waste Incineration	0,00	0,00	0,00	NE	NE	NE	NE
4.C.2 - Open Burning of Waste	0,03	0,00	0,00	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NA	0,44	0,00	NA	NA	NA	
4.D.1 - Domestic Wastewater Treatment and Discharge		0,22	0,00	NA	NA	NA	
4.D.2 - Industrial Wastewater Treatment and Discharge		0,22	NE	NA	NA	NA	
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO

4.9 Quantitative uncertainty analysis

Table 4-20. Uncertainty Assessment: GHG Inventory for year 2008 – (without LULUCF)

IPCC Category/fuels	Gas	Emissions 2008 kt $CO_{2\text{-eq}}$	Activity data uncertainty 2008 (%)	Emission factor uncertainty 2008 (%)	Combined uncertainty 2008 (%)	Uncertainty combined (%) in the total national emissions excl. LULUCF 2008 (%)	Uncertainty combined (%) in the total national emissions incl. LULUCF 2008 (%)
1.A.1-Energy Industries/Liquid fuels	CO_2	149,5	5	7	9	4,3	5,5
1.A.1-Energy Industries/Liquid fuels	CH_4	0,2	5	100	100	0,1	0,1
1.A.1-Energy Industries/Liquid fuels	N_2O	0,3	5	150	150	0,2	0,2
1.A.1-Energy Industries/Solid fuels	CO_2	0,0	5	7	9	0,0	0,0
1.A.1-Energy Industries/Solid fuels	CH_4	0,0	5	100	100	0,0	0,0
1.A.1-Energy Industries/Solid fuels	N_2O	0,0	5	150	150	0,0	0,0
1.A.1-Energy Industries/Gaseous fuels	CO_2	0,0	5	7	9	0,0	0,0
1.A.1-Energy Industries/Gaseous fuels	CH_4	0,0	5	100	100	0,0	0,0
1.A.1-Energy Industries/Gaseous fuels	N_2O	0,0	5	150	150	0,0	0,0
1.A.1-Energy Industries/Other fossil fuels	CO_2	0,0	5	7	9	0,0	0,0
1.A.1-Energy Industries/Other fossil fuels	CH_4	0,0	5	100	100	0,0	0,0
1.A.1-Energy Industries/Other fossil fuels	N_2O	0,0	5	150	150	0,0	0,0
1.A.1-Energy Industries/Biomass	CH_4	0,0	5	150	150	0,0	0,0
1.A.1-Energy Industries/Biomass	N_2O	0,0	5	150	150	0,0	0,0
1.A.2-Manufacturing Industries/Liquid fuels	CO_2	4,4	20	7	21	0,3	0,4
1.A.2-Manufacturing Industries/Liquid fuels	CH_4	0,0	20	100	102	0,0	0,0
1.A.2-Manufacturing Industries/Liquid fuels	N_2O	0,0	20	150	151	0,0	0,0
1.A.2-Manufacturing Industries/Solid fuels	CO_2	0,0	20	7	21	0,0	0,0
1.A.2-Manufacturing Industries/Solid fuels	CH_4	0,0	20	100	102	0,0	0,0

IPCC Category/fuels	Gas	Emissions 2008 kt $CO_{2\text{-eq}}$	Activity data uncertainty 2008 (%)	Emission factor uncertainty 2008 (%)	Combined uncertainty 2008 (%)	Uncertainty combined (%) in the total national emissions excl. LULUCF 2008 (%)	Uncertainty combined (%) in the total national emissions incl. LULUCF 2008 (%)
1.A.2-Manufacturing Industries/Solid fuels	N_2O	0,0	20	150	151	0,0	0,0
1.A.2-Manufacturing Industries/Gaseous fuels	CO_2	0,0	20	7	21	0,0	0,0
1.A.2-Manufacturing Industries/Gaseous fuels	CH_4	0,0	20	100	102	0,0	0,0
1.A.2-Manufacturing Industries/Gaseous fuels	N_2O	0,0	20	150	151	0,0	0,0
1.A.2-Manufacturing Industries/Other fossil fuels	CO_2	0,0	20	7	21	0,0	0,0
1.A.2-Manufacturing Industries/Other fossil fuels	CH_4	0,0	20	100	102	0,0	0,0
1.A.2-Manufacturing Industries/Other fossil fuels	N_2O	0,0	20	150	151	0,0	0,0
1.A.2-Manufacturing Industries/Biomass	CH_4	0,0	60	150	162	0,0	0,0
1.A.2-Manufacturing Industries/Biomass	N_2O	0,0	60	150	162	0,0	0,0
1.A.3-Transport/-	CO_2	69,0	10	5	11	2,6	3,3
1.A.3-Transport/-	CH_4	0,4	10	50	51	0,1	0,1
1.A.3-Transport/-	N_2O	1,6	10	380	380	2,0	2,6
1.A.4-Commercial, resid., agriculture…/Liquid fuels	CO_2	12,6	20	7	21	0,9	1,1
1.A.4-Commercial, resid., agriculture…/Liquid fuels	CH_4	0,0	20	100	102	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Liquid fuels	N_2O	0,0	20	150	151	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Solid fuels	CO_2	0,0	20	7	21	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Solid fuels	CH_4	0,0	20	100	102	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Solid fuels	N_2O	0,0	20	150	151	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Gaseous fuels	CO_2	0,0	20	7	21	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Gaseous fuels	CH_4	0,0	20	100	102	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Gaseous fuels	N_2O	0,0	20	150	151	0,0	0,0

IPCC Category/fuels	Gas	Emissions 2008 kt $CO_{2\text{-eq}}$	Activity data uncertainty 2008 (%)	Emission factor uncertainty 2008 (%)	Combined uncertainty 2008 (%)	Uncertainty combined (%) in the total national emissions excl. LULUCF 2008 (%)	Uncertainty combined (%) in the total national emissions incl. LULUCF 2008 (%)
1.A.4-Commercial, resid., agriculture…/Other fossil fuels	CO_2	0,0	60	7	60	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Other fossil fuels	CH_4	0,0	60	100	117	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Other fossil fuels	N_2O	0,0	20	150	151	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Biomass	CH_4	0,0	60	100	117	0,0	0,0
1.A.4-Commercial, resid., agriculture…/Biomass	N_2O	0,0	60	150	162	0,0	0,0
1.B.1-Fugitive Emissions / Solid Fuels/-	CO_2	0,0	0	0	0	0,0	0,0
1.B.1-Fugitive Emissions / Solid Fuels/-	CH_4	0,0	5	20	21	0,0	0,0
1.B.1-Fugitive Emissions / Solid Fuels/-	N_2O	0,0	0	0	0	0,0	0,0
1.B.2-Fugitive Emissions / Oil & Natural gas/-	CO_2	0,0	10	2	10	0,0	0,0
1.B.2-Fugitive Emissions / Oil & Natural gas/-	CH_4	0,0	10	100	100	0,0	0,0
1.B.2-Fugitive Emissions / Oil & Natural gas/-	N_2O	0,0	10	100	100	0,0	0,0
2.A-Mineral industry /-	CO_2	0,0	2	2	3	0,0	0,0
2.B-Chemical industry/-	CO_2	0,0	5	6	8	0,0	0,0
2.B-Chemical industry/-	CH_4	0,0	2	2	3	0,0	0,0
2.B-Chemical industry/-	N_2O	0,0	2	40	40	0,0	0,0
2.C-Metal industry/-	CO_2	0,0	10	25	27	0,0	0,0
2.C-Metal industry/-	CH_4	0,0	10	25	27	0,0	0,0
2.C-Metal industry/-	SF_6	0,0	20	5	21	0,0	0,0
2.D-Non-energy products from fuels and solvent use /-	CO_2	0,0	15	50	52	0,0	0,0
2.F-Product uses as substitutes for ODS/-	HFC	0,0	20	20	28	0,0	0,0
3.A-Enteric Fermentation/-	CH_4	15,0	20	40	45	2,2	2,9
3.B-Manure Management/-	CH_4	0,8	20	30	36	0,1	0,1
3.B-Manure Management/-	N_2O	1,6	20	50	54	0,3	0,4
3.D.1-Direct N2O emissions from managed soils/-	N_2O	2,5	5	300	300	2,5	3,2

IPCC Category/fuels	Gas	Emissions 2008 kt $CO_{2\text{-eq}}$	Activity data uncertainty 2008 (%)	Emission factor uncertainty 2008 (%)	Combined uncertainty 2008 (%)	Uncertainty combined (%) in the total national emissions excl. LULUCF 2008 (%)	Uncertainty combined (%) in the total national emissions incl. LULUCF 2008 (%)
3.D.2-Indirect N2O Emissions from managed soils /-	N_2O	0,6	5	300	300	0,6	0,8
3.F-Field burning of agricultural residues/-	CH_4	0,0	30	100	104	0,0	0,0
3.F-Field burning of agricultural residues/-	N_2O	0,0	30	100	104	0,0	0,0
3.G-Liming/-	CO_2	0,0	20	20	28	0,0	0,0
3.H-Urea application/-	CO_2	0,0	5	50	50	0,0	0,0
4.A-Forest Land/-	CO_2	-130,0	10	20	22		12,4
4.A-Forest Land/-	CH_4	0,0	10	100	100		0,0
4.A-Forest Land/-	N_2O	0,0	10	100	100		0,0
4.B-Cropland/-	CO_2	16,5	10	40	41		2,9
4.B-Cropland/-	N_2O	0,0	10	100	100		0,0
4.C-Grassland/-	CO_2	20,8	10	50	51		4,5
4.C-Grassland/-	CH_4	0,0	10	100	100		0,0
4.C-Grassland/-	N_2O	0,0	10	100	100		0,0
4.D-Wetlands/-	CO_2	0,0	10	70	71		0,0
4.D-Wetlands/-	N_2O	0,0	10	100	100		0,0
4.E-Settlements/-	CO_2	3,4	10	30	32		0,5
4.E-Settlements/-	N_2O	0,0	10	100	100		0,0
4.F-Other Land/-	CO_2	23,5	10	80	81		8,1
4.F-Other Land/-	N_2O	0,0	0	0	0		0,0
4.G-Harvested Wood Products/-	CO_2	0,0	10	100	100		0,0
5.A-Solid Waste Disposal on Land/-	CH_4	35,8	77	65	101	12,0	15,4
5.C- Incineration and open burning of waste/0	CO_2	0,0	30	40	50	0,0	0,0
5.C- Incineration and open burning of waste/0	CH_4	0,1	30	100	104	0,0	0,0
5.C- Incineration and open burning of waste/0	N_2O	0,0	30	100	104	0,0	0,0
5.D-Wastewater treatment and discharge/-	CH_4	5,0	50	50	71	1,2	1,5
5.D-Wastewater treatment and discharge/-	N_2O	0,6	50	100	112	0,2	0,3
Uncertainty of total emissions- 2008						**13,7**	**23,6**

Table 4-21. Uncertainty Assessment GHG Inventory for Year 2018 – (without LULUCF)

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.1	Energy Industries	Liquid fuels	CO_2	149,4808206	181,145091	5	7	8,6	5,3	0,2	0,5	1,1	3,7	3,8
1.A.1	Energy Industries	Liquid fuels	CH_4	0,169451942	0,205346662	5	100	100,1	0,1	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Liquid fuels	N_2O	0,320748319	0,388691896	5	150	150,1	0,2	0,0	0,0	0,1	0,0	0,1
1.A.1	Energy Industries	Solid fuels	CO_2	0	0	5	7	8,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Solid fuels	CH_4	0	0	5	100	100,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Solid fuels	N_2O	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Gaseous fuels	CO2	0	0	5	7	8,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Gaseous fuels	CH_4	0	0	5	100	100,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Gaseous fuels	N_2O	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Other fossil fuels	CO_2	0	0	5	7	8,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Other fossil fuels	CH_4	0	0	5	100	100,1	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.1	Energy Industries	Other fossil fuels	N_2O	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Biomass	CH_4	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Biomass	N_2O	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Liquid fuels	CO_2	4,41205219	5,90039869	20	7	21,2	0,4	0,0	0,0	0,0	0,5	0,5
1.A.2	Manufacturing Industries	Liquid fuels	CH_4	0,005001517	0,006688711	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Liquid fuels	N_2O	0,009467157	0,012660775	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Solid fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Solid fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Solid fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Gaseous fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Gaseous fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Gaseous fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.2	Manufacturing Industries	Other fossil fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Other fossil fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Other fossil fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Biomass	CH_4	0	0	60	150	161,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Biomass	N_2O	0	0	60	150	161,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.3	Transport	-	CO_2	69,00737826	98,1702937	10	5	11,2	3,7	0,1	0,3	0,6	4,0	4,0
1.A.3	Transport	-	CH_4	0,35552657	0,233062047	10	50	51,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.3	Transport	-	N_2O	1,594620838	2,040424494	10	380	380,1	2,6	0,0	0,0	0,7	0,1	0,8
1.A.4	Commercial, resid., agriculture…	Liquid fuels	CO_2	12,58829599	7,037510556	20	7	21,2	0,5	0,0	0,0	-0,1	0,6	0,6
1.A.4	Commercial, resid., agriculture…	Liquid fuels	CH_4	0,032963897	0,017954727	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.4	Commercial, resid., agriculture…	Liquid fuels	N_2O	0,010855993	0,005544904	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Solid fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Solid fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Solid fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Gaseous fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Gaseous fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Gaseous fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Other fossil fuels	CO_2	0	0	60	7	60,4	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Other fossil fuels	CH_4	0	0	60	100	116,6	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.4	Commercial, resid., agriculture…	Other fossil fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Biomass	CH_4	0,007357025	0,009354308	60	100	116,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Biomass	N_2O	0,000468988	0,000585934	60	150	161,6	0,0	0,0	0,0	0,0	0,0	0,0
1.B.1	Fugitive Emissions / Solid Fuels	-	CO_2	0	0	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1.B.1	Fugitive Emissions / Solid Fuels	-	CH_4	0	0	5	20	20,6	0,0	0,0	0,0	0,0	0,0	0,0
1.B.1	Fugitive Emissions / Solid Fuels	-	N_2O	0	0	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1.B.2	Fugitive Emissions / Oil & Natural gas	-	CO_2	0,001348678	0,002288069	10	2	10,2	0,0	0,0	0,0	0,0	0,0	0,0
1.B.2	Fugitive Emissions / Oil & Natural gas	-	CH_4	0	0	10	100	100,5	0,0	0,0	0,0	0,0	0,0	0,0
1.B.2	Fugitive Emissions / Oil & Natural gas	-	N_2O	0	0	10	100	100,5	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
2.A	Mineral industry	-	CO_2	0	0	2	2	2,8	0,0	0,0	0,0	0,0	0,0	0,0
2.B	Chemical industry	-	CO_2	0	0	5	6	7,8	0,0	0,0	0,0	0,0	0,0	0,0
2.B	Chemical industry	-	CH_4	0	0	2	2	2,8	0,0	0,0	0,0	0,0	0,0	0,0
2.B	Chemical industry	-	N_2O	0	0	2	40	40,0	0,0	0,0	0,0	0,0	0,0	0,0
2.C	Metal industry	-	CO_2	0	0	10	25	26,9	0,0	0,0	0,0	0,0	0,0	0,0
2.C	Metal industry	-	CH_4	0	0	10	25	26,9	0,0	0,0	0,0	0,0	0,0	0,0
2.C	Metal industry	-	SF_6	0	0	20	5	20,6	0,0	0,0	0,0	0,0	0,0	0,0
2.D	Non-energy products from fuels and solvent use	-	CO_2	0	0	15	50	52,2	0,0	0,0	0,0	0,0	0,0	0,0
2.F	Product uses as substitutes for ODS	-	HFC	0	0	20	20	28,3	0,0	0,0	0,0	0,0	0,0	0,0
3.A	Enteric Fermentation	-	CH_4	14,952	5,169836	20	40	44,7	0,8	0,0	0,0	-0,9	0,4	1,0
3.B	Manure Management	-	CH_4	0,76384	0,63232456	20	30	36,1	0,1	0,0	0,0	0,0	0,1	0,1
3.B	Manure Management	-	N_2O	1,59819035	1,346237854	20	50	53,9	0,2	0,0	0,0	0,0	0,1	0,1
3.D.1	Direct N2O emissions from managed soils	-	N_2O	2,484409873	1,794607812	5	300	300,0	1,8	0,0	0,0	-0,3	0,0	0,3

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
3.D.2	Indirect N2O Emissions from managed soils	-	N_2O	0,63966953	0,499745552	5	300	300,0	0,5	0,0	0,0	0,0	0,0	0,0
3.F	Field burning of agricultural residues	-	CH_4	0	0	30	100	104,4	0,0	0,0	0,0	0,0	0,0	0,0
3.F	Field burning of agricultural residues	-	N_2O	0	0	30	100	104,4	0,0	0,0	0,0	0,0	0,0	0,0
3.G	Liming	-	CO_2	0,0055	0,005133333	20	20	28,3	0,0	0,0	0,0	0,0	0,0	0,0
3.H	Urea application	-	CO_2	0,0055	0,005133333	5	50	50,2	0,0	0,0	0,0	0,0	0,0	0,0
5.A	Solid Waste Disposal on Land	-	CH_4	35,84866125	45,90332946	77	65	100,8	15,6	0,0	0,1	2,9	3,4	4,5
5.C	Incineration and open burning of waste		CO_2	0,027222465	0,029629533	30	40	50,0	0,0	0,0	0,0	0,0	0,0	0,0
5.C	Incineration and open burning of waste		CH_4	0,082072187	0,089329182	30	100	104,4	0,0	0,0	0,0	0,0	0,0	0,00591
5.C	Incineration and open burning of waste		N_2O	0,014877839	0,016069227	30	100	104,4	0,0	0,0	0,0	0,0	0,0	0,00103
5.D	Wastewater treatment and discharge	-	CH_4	4,963181933	12,2123085	50	50	70,7	2,9	0,0	0,0	1,1	1,1	1,61935

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
5.D	Wastewater treatment and discharge	-	N_2O	0,612685194	0,667413736	50	100	111,8	0,3	0,0	0,0	0,0	0,0	0,04745
		TOTAL		**300,0**	**363,5**				**14,2**					**6,9**

Table 4-22. Uncertainty assessment GHG Inventory for year 2018 – (with LULUCF)

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.1	Energy Industries	Liquid fuels	CO_2	149,4808206	181,145091	5	7	8,6	6,2	0,1	0,8	0,6	5,5	5,5
1.A.1	Energy Industries	Liquid fuels	CH_4	0,169451942	0,205346662	5	100	100,1	0,1	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Liquid fuels	N_2O	0,320748319	0,388691896	5	150	150,1	0,2	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Solid fuels	CO_2	0	0	5	7	8,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Solid fuels	CH_4	0	0	5	100	100,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Solid fuels	N_2O	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Gaseous fuels	CO2	0	0	5	7	8,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Gaseous fuels	CH_4	0	0	5	100	100,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Gaseous fuels	N_2O	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Other fossil fuels	CO_2	0	0	5	7	8,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Other fossil fuels	CH_4	0	0	5	100	100,1	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.1	Energy Industries	Other fossil fuels	N_2O	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Biomass	CH_4	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.1	Energy Industries	Biomass	N_2O	0	0	5	150	150,1	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Liquid fuels	CO_2	4,41205219	5,90039869	20	7	21,2	0,5	0,0	0,0	0,0	0,7	0,7
1.A.2	Manufacturing Industries	Liquid fuels	CH_4	0,005001517	0,006688711	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Liquid fuels	N_2O	0,009467157	0,012660775	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Solid fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Solid fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Solid fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Gaseous fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Gaseous fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Gaseous fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.2	Manufacturing Industries	Other fossil fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Other fossil fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Other fossil fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Biomass	CH_4	0	0	60	150	161,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.2	Manufacturing Industries	Biomass	N_2O	0	0	60	150	161,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.3	Transport	-	CO_2	69,00737826	98,1702937	10	5	11,2	4,4	0,1	0,4	0,5	5,9	6,0
1.A.3	Transport	-	CH_4	0,35552657	0,233062047	10	50	51,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.3	Transport	-	N_2O	1,594620838	2,040424494	10	380	380,1	3,1	0,0	0,0	0,5	0,1	0,6
1.A.4	Commercial, resid., agriculture…	Liquid fuels	CO_2	12,58829599	7,037510556	20	7	21,2	0,6	0,0	0,0	-0,2	0,9	0,9
1.A.4	Commercial, resid., agriculture…	Liquid fuels	CH_4	0,032963897	0,017954727	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.4	Commercial, resid., agriculture…	Liquid fuels	N_2O	0,010855993	0,005544904	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Solid fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Solid fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Solid fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Gaseous fuels	CO_2	0	0	20	7	21,2	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Gaseous fuels	CH_4	0	0	20	100	102,0	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Gaseous fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Other fossil fuels	CO_2	0	0	60	7	60,4	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Other fossil fuels	CH_4	0	0	60	100	116,6	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
1.A.4	Commercial, resid., agriculture…	Other fossil fuels	N_2O	0	0	20	150	151,3	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Biomass	CH_4	0,007357025	0,009354308	60	100	116,6	0,0	0,0	0,0	0,0	0,0	0,0
1.A.4	Commercial, resid., agriculture…	Biomass	N_2O	0,000468988	0,000585934	60	150	161,6	0,0	0,0	0,0	0,0	0,0	0,0
1.B.1	Fugitive Emissions / Solid Fuels	-	CO_2	0	0	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1.B.1	Fugitive Emissions / Solid Fuels	-	CH_4	0	0	5	20	20,6	0,0	0,0	0,0	0,0	0,0	0,0
1.B.1	Fugitive Emissions / Solid Fuels	-	N_2O	0	0	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1.B.2	Fugitive Emissions / Oil & Natural gas	-	CO_2	0,001348678	0,000797739	10	2	10,2	0,0	0,0	0,0	0,0	0,0	0,0
1.B.2	Fugitive Emissions / Oil & Natural gas	-	CH_4	0	0	10	100	100,5	0,0	0,0	0,0	0,0	0,0	0,0
1.B.2	Fugitive Emissions / Oil & Natural gas	-	N_2O	0	0	10	100	100,5	0,0	0,0	0,0	0,0	0,0	0,0

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
2.A	Mineral industry	-	CO_2	0	0	2	2	2,8	0,0	0,0	0,0	0,0	0,0	0,0
2.B	Chemical industry	-	CO_2	0	0	5	6	7,8	0,0	0,0	0,0	0,0	0,0	0,0
2.B	Chemical industry	-	CH_4	0	0	2	2	2,8	0,0	0,0	0,0	0,0	0,0	0,0
2.B	Chemical industry	-	N_2O	0	0	2	40	40,0	0,0	0,0	0,0	0,0	0,0	0,0
2.C	Metal industry	-	CO_2	0	0	10	25	26,9	0,0	0,0	0,0	0,0	0,0	0,0
2.C	Metal industry	-	CH_4	0	0	10	25	26,9	0,0	0,0	0,0	0,0	0,0	0,0
2.C	Metal industry	-	SF_6	0	0	20	5	20,6	0,0	0,0	0,0	0,0	0,0	0,0
2.D	Non-energy products from fuels and solvent use	-	CO_2	0	0	15	50	52,2	0,0	0,0	0,0	0,0	0,0	0,0
2.F	Product uses as substitutes for ODS	-	HFC	0	0	20	20	28,3	0,0	0,0	0,0	0,0	0,0	0,0
3.A	Enteric Fermentation	-	CH_4	14,952	5,169836	20	40	44,7	0,9	0,0	0,0	-1,8	0,6	2,0
3.B	Manure Management	-	CH_4	0,76384	0,63232456	20	30	36,1	0,1	0,0	0,0	0,0	0,1	0,1
3.B	Manure Management	-	N_2O	1,59819035	1,346237854	20	50	53,9	0,3	0,0	0,0	-0,1	0,2	0,2
3.D.1	Direct N2O emissions from managed soils	-	N_2O	2,484409873	1,794607812	5	300	300,0	2,1	0,0	0,0	-1,1	0,1	1,1

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
3.D.2	Indirect N2O Emissions from managed soils	-	N_2O	0,63966953	0,499745552	5	300	300,0	0,6	0,0	0,0	-0,2	0,0	0,2
3.F	Field burning of agricultural residues	-	CH_4	0	0	30	100	104,4	0,0	0,0	0,0	0,0	0,0	0,0
3.F	Field burning of agricultural residues	-	N_2O	0	0	30	100	104,4	0,0	0,0	0,0	0,0	0,0	0,0
3.G	Liming	-	CO_2	0,0055	0,005133333	20	20	28,3	0,0	0,0	0,0	0,0	0,0	0,0
3.H	Urea application	-	CO_2	0,0055	0,005133333	5	50	50,2	0,0	0,0	0,0	0,0	0,0	0,0
5.A	Solid Waste disposal on land	-	CH_4	-130,0152678	-140,3424357	10	20	22,4	12,5	0,0	0,6	-0,1	8,5	8,5
5.C	Incineration and open burning of waste		CO_2	0	0	10	100	100,5	0,0	0,0	0,0	0,0	0,0	0,0
5.C	Incineration and open burning of waste		CH_4	0	0	10	100	100,5	0,0	0,0	0,0	0,0	0,0	0,0
5.C	Incineration and open burning of waste		N_2O	16,49191366	10,3275189	10	40	41,2	1,7	0,0	0,0	-1,2	0,6	1,4

CRF	Category	Fuel	Gas	Base year (2008)	Last year (2018)	AD_uncertainty_%	EF_uncertainty_%	Combined uncertainty (%)	Contribution to Variance by Category *incl. LULUCF* (%)	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend introduced by EF (%)	Uncertainty in trend introduced by activity data (%)	Uncertainty in trend *incl. LULUCF* (%)
5.D	Wastewater treatment and discharge	-	CH_4	0	0	10	100	100,5	0,0	0,0	0,0	0,0	0,0	0,0
5.D	Wastewater treatment and discharge	-	N_2O	20,836344 44	13,7254625 9	10	50	51,0	2,8	0,0	0,1	-1,8	0,8	2,0
		TOTAL		**234,1**	**250,4**				**24,4**					**15,0**

4.10 Details of the improvement plan

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
S1	n.a.	MRV system not yet established.	Matej Gasperic	Set-up MRV system with appropriate administrative capacity and with focus on the Department of Customs as main data source provider.	2022-2023	HIGH
S2	n.a.	Data collection, processing and reporting efforts need to yield better data more efficiently.	Matej Gasperic	Establish and implement a sustainable MRV System with appropriate institutional procedural, and legal arrangements with clear reporting and documentation requirements.	2022-2023	HIGH
S3	n.a.	Performance indicators are needed to monitor the level of implementation of mitigation and adaptation actions.	Matej Gasperic	Develop and track set of national MRV performance indicators to monitor the implementation and progress of mitigation and adaptation actions.	2022-2024	MEDIUM
S4	n.a.	Need for established MRV QA/QC procedures.	Matej Gasperic	Embed QC procedures throughout the MRV system and enact a set of QA procedures to assess the accuracy of final GHG inventory estimates.	2022-2023	HIGH
S5	n.a.	Performance indicators need to be established and tracked.	Matej Gasperic	Develop a system to monitor national MRV performance indicators track the level of implementation of	2022-2024	MEDIUM

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
				mitigation and adaptation actions.		
E1	1.A.1.a	Need better dataset completeness for the period 2008-2010.	Matej Gasperic	Collect the missing data of fuel consumption for Nevis Electricity Company Limited - Prospect Power Station Royal Utilities - Marriot Frigate Bay for the period 2008-2010.	2022	LOW
E2	1.A.1.a	Royal Utilities - Marriot Frigate Bay is measuring only one parameter (electricity production or fuel consumption) and calculate the other.	Matej Gasperic	Identify which parameter is the producer de-facto measuring and which is calculated through efficiency.	2022	LOW
E3	1.A.1.c	Identify potential producers of charcoal and estimate the amount of produced charcoal (if any) in the charcoal sold to the market.	Matej Gasperic	If charcoal is produced in SKN, estimate the amount of wood used for charcoal production and estimate the emissions.	2022/2023	LOW
E4	1.A.2.k	AD allocation needs Improvement.	Matej Gasperic	Collect the data on AD for construction using national MRV system.	2023-2025	MEDIUM
E5	1.A.2.e	AD allocation needs Improvement.	Matej Gasperic	Collect the data on AD for construction using national MRV system.	2023-2025	MEDIUM
E6	1.A.3.a	No consistent data-series for Jet Kerosene and Jet Gasoline available.	Matej Gasperic	Extract air control data for specific year to get the number of domestic flights and aircraft type between SKB-NEV	2021/2022	HIGH

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
				(arrivals and departures).		
E7	1.A.3.a	No consistent data-series for Jet Kerosene and Jet Gasoline available.	Matej Gasperic	Collect data on passengers on domestic route (SKB-NEV) from departure fees from St. Kitts Sea and Port Authority.	2021/2022	HIGH
E8	1.A.3.b	Extraction of the fleet database is to be rearranged since currently there is only one fleet dataset (appears to be for 2020).	Matej Gasperic	Collect raw data frozen on 31.12 for every year of the period 2008-2018 (at the end of the year the back-ups are made).	2021/2022	MEDIUM
E9	1.A.3.b	Current values under the dataset weight column does not represent GWT	Matej Gasperic	Extract maximum permissible weight of a vehicle in order to allow for proper classification of vehicles.	2021/2022	MEDIUM
E10	1.A.3.b	No data on engine volume.	Matej Gasperic	Extract the data from the original database is this data is contained in the database of vehicles.	2021/2022	MEDIUM
E11	1.A.3.b	Currently there is no primary key in the database.	Matej Gasperic	If VIN is collected add VIN number to the database as primary key.	2021/2022	LOW
E12	1.A.3.d	There in activity data on domestic navigation	Matej Gasperic	Collect the 2008-recent fuel consumption data from - Sea Bridge St Kitts & Nevis Inc and M&M Transportation Services Ltd.	2021/2022	HIGH

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
E13	1.A.3.d	There in activity data on domestic navigation	Matej Gasperic	Collect the 2008-recent fuel consumption data from operator of the Fisheries Gas Station.	2021/2022	HIGH
E14	1.A.4.a	2016 data for LPG consumption is an outlier.	Matej Gasperic	Re-check the 2016 data as reported and identify if potential stock changes can contribute to the inconsistency (LPG storage capacity is at the level of inconsistency cca 700m3).	2021/2022	MEDIUM
E15	1.A.4.b	Improve the AD allocation.	Matej Gasperic	Collect the data on AD for construction using national MRV system.	2023-2025	MEDIUM
E16	1.A.4.c	Improve the AD allocation.	Matej Gasperic	Collect the data on fuel used for domestic fishing activities.	2022/2023	MEDIUM
I1	2.D.1	Emissions from lubricant use are not yet estimated.	Matej Gasperic	Once the AD on road transport is improved, estimate the lubricant use using bottom-up approach and calibrate the approach using customs data on lubricant imports.	2023-2025	MEDIUM
I2	2.D.2	Emissions from paraffin wax use are not yet estimated.	Matej Gasperic	Estimate the paraffin wax use using customs data.	2023-2025	LOW
I3	2.D.3	Emissions from solvent use	Matej Gasperic	Estimate the solvent use using customs data or average regional data on solvent use per capita if available.	2025	LOW

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
I4	2.F.1.a	Emissions of F-gases from Refrigeration and stationary Air Conditioning are not yet estimates	Matej Gasperic	Estimate the amount of stationary air conditioning in place in households bottom-up using the surveys, direct questionnaires for bigger commercial facilities and hospitality sector. Calibrate the approach with top-down information on the import of F-gasses and AC appliances.	2022-2023	HIGH
I5	2.F.1.b	Emissions of F-gases from Mobile Air Conditioning are not yet estimated.	Matej Gasperic	Once the AD on road transport (vehicle fleet) are improved, estimate the amount of F-gases emissions using leakage factors as used by Annex I parties from where the majority of the car imports occur.	2022-2023	HIGH
I6	2.G.1.b	Emissions of F-gases (SF6) from switchgear equipment is not yet estimated or determined that it is not occurring.	Matej Gasperic	Investigate with the electric distribution system if the switchgear equipment contains SF6.	2023-2025	LOW
L1	4A-F	Generation of the country specific Emissions Factor for CO2 emission is critical to move from Tier 1 to higher Tier methodology.	Anup Joshi	Field Survey and Measurements to develop country specific emission factors will help improve accuracy of GHG emissions.	2022-2025	HIGH

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
L2	4A-F	To fully utilize Tier 3 activity data that SKN has for 2000-2020, generation of Emission Factors for all Land categories is crucial.	Anup Joshi	Generating emission factors for forest, grasslands and wetlands with woody vegetation should be made priority.	2023-2025	HIGH
L3	4A-F	Necessary methods and scripts have been developed. Training in-country personnel to estimate GHG emissions from FOLU sector should be a priority.	Anup Joshi	The scripts to run classification and generate Tier 3 land activity data has been developed in Google Earth Engine.	Should be done as a part of L1 and L2. 2024-2025	MEDIUM
L4	4A-F	Generation of activity data for current reporting heavily relied on remote sensing data with digital verification by consultants. To improve the quality of data country experts with the knowledge of land use history in the country will be required.		Training someone with ground knowledge of the country and some GIS expertise will build the capacity of St. Kitts and Nevis for future reporting requirements.	L1-L4 should be done as a single training package to be efficient and cost-effective. 2022-2025	HIGH
A1		Submitted livestock population count data was reflective for St. Kitts for 2014 onwards but did not include complete estimates for Nevis. No information on the	Ryan Deosaran	Country experts should begin to collect livestock population counts for Nevis to be integrated with estimates from St. Kitts. Information on collection procedures inclusive of timelines	2022-2024	HIGH

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
		procedural elements for the collection of data was provided.		should be submitted to the inventory compilation team for future reporting cycles.		
A2		Manure Management System allocations were provided by the Party. Though MMS relevant to the party have been identified, no information on % allocation of livestock to the MMS was provided. An assumption of a 50-50 split was assumed when livestock was categorized into two MMS.	Ryan Deosaran	Validation of MMS information during the current GHGI cycle by the country team. Given the different reporting sub-categories to be reported under between pasture/range/paddock and other manure management systems, it is important for the local team to provide expert judgement on the % of livestock for each given MMS.	2022-2024	MEDIUM
A3		FAOSTAT livestock dataset for the years 2000-2018 were sourced by the inventory team. For the period of 2014 onwards, these datasets were not reflective of what was submitted by the SKN team for the same time period.	Ryan Deosaran	Investigate the source for the FAOSTAT dataset and compare results to census data and livestock counts provided by local team.	2022-2024	HIGH
A4		No country data was provided for total fertiliser imports with datasets being	Ryan Deosaran	Investigate the source for the FAOSTAT dataset. As country specific information was not available during the	2022-2024	MEDIUM

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
		sourced through FAOSTAT.		preparation of the inventory, the local SKN expert team should highlight the datasets needed to be collected by the Customs division and include in their data collection procedures for the next inventory cycle.		
A5		Urea Import data was available through FAOSTAT for the timeseries 2002-2017 and the SKN team through sales records from the local distributor (2015, 2017 and 2018). The GHGI compilation team chose the FAOSTAT dataset due to differences in estimates, data gaps and a longer available timeseries.	Ryan Deosaran	Investigate the source of the FAOSTAT dataset. The SKN team should request from the local distributor access to their historical sales records and compare against the FAOSTAT data set for validation.	2022-2024	LOW
W1		% Distribution by waste management type was provided by local experts without submitted background information and validation of estimates.	Ryan Deosaran	Survey and/or study should be carried out by local experts to validate assumptions made for timeseries prior to 2002 (50-50 split for managed/unmanaged) and for the 100% allocation to managed waste disposal sites (2003-present).	2022-2024	MEDIUM

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
W2		Submitted waste tonnage values collected by the Party were available for 2009- 2018 with no submitted background information on the collection and validation process. Estimates for Nevis for some years were unavailable.	Ryan Deosaran	Continued work validating previous waste tonnage estimated as submitted to the inventory team and continued comparison with newly available 2019 refinement default values of waste per capita. Continued collection of waste tonnage values for all relevant disposal sites.	2022-2028	HIGH
W3		Information submitted for waste composition categorisation was not in the required IPCC categories. Country definitions for composition categories.	Ryan Deosaran	Collection of future waste composition data should be reflective of necessary IPCC categorisations or country definitions for current categorisations should be provided to allow for integration of information by the GHGI compilation team.	2022-2024	MEDIUM
W4		No information on the collection and disposal of industrial solid waste	Ryan Deosaran	Survey and/or study should be carried out by local experts to track industrial solid waste flows by reporting entity as well as final disposal site.	2022-2023	MEDIUM
W5		No country definition for the inclusion of Industrial Waste in the MSW sub-category.	Ryan Deosaran	Country experts as well as relevant government entities should provide the definition inclusive of any background	2022-2024	LOW

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
				information/expert judgement. (Relevant if Party assumes this allocation in the next reporting cycle.)		
W6		Assumption of 2% allocation of fraction of population burning waste was based on in-country expert judgement.	Ryan Deosaran	Survey and/or study should be carried out to validate 2% assumption before the next GHGI cycle.	2022-2024	LOW
W7		Data was submitted for St. Kitts and Nevis for applicable wastewater treatment and discharge systems for the entire population. No information was provided on the breakdown of treatment systems by rural, urban high income and urban low-income allocations.	Ryan Deosaran	Survey and/or study should be conducted based on degree of utilisation of the identified wastewater treatment systems by IPCC urbanisation characterisation.	2022-2024	HIGH
W8		No country data was provided for Degradable Organic Component (BOD) in kg/capita/BOD/year	Ryan Deosaran	Data collection for this specific input should be identified and requested from the relevant in-country experts. Conduct initial study/survey if no historical information is available.	2022-2024	Low

Identified areas of improvements						
N°	CRF code	Identified issues for Improvements	Initiated by	Recommendations for the actions to be taken	Proposed timeline for implementation	Priority level
W9		Wastewater generation values were provided to the GHGI compilation team for the years 2009-2018. It was noted that values for 2009-2013 and 2015-2018 were duplicative.	Ryan Deosaran	Wastewater generation values should be validated by the data provider and Party to ensure that submitted information is accurate (due to duplicative figures over the timeseries).	2022-2024	MEDIUM
W10		The identified wastewater treatment system identified by the data provider was the Evaporation Process. No additional information was provided to estimate the relevant emission factors using B_0 and MCF.	Ryan Deosaran	Additional data and information on the identified evaporation process treatment system should be provided by the relevant stakeholder to local experts with estimates for B_0 and MCF if available.	2022-2024	HIGH

4.11 Raw satellite images and classified maps for 2000-2018

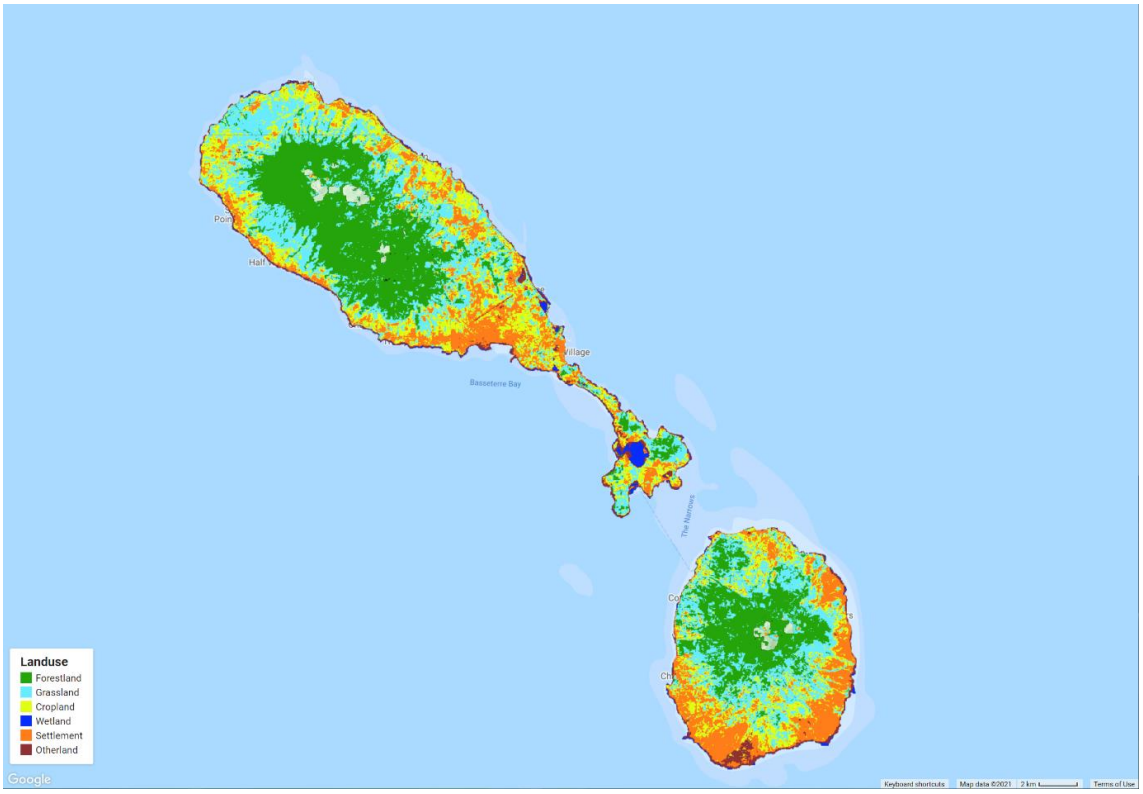
Landsat satellite image 2000

Landsat satellite image 2005

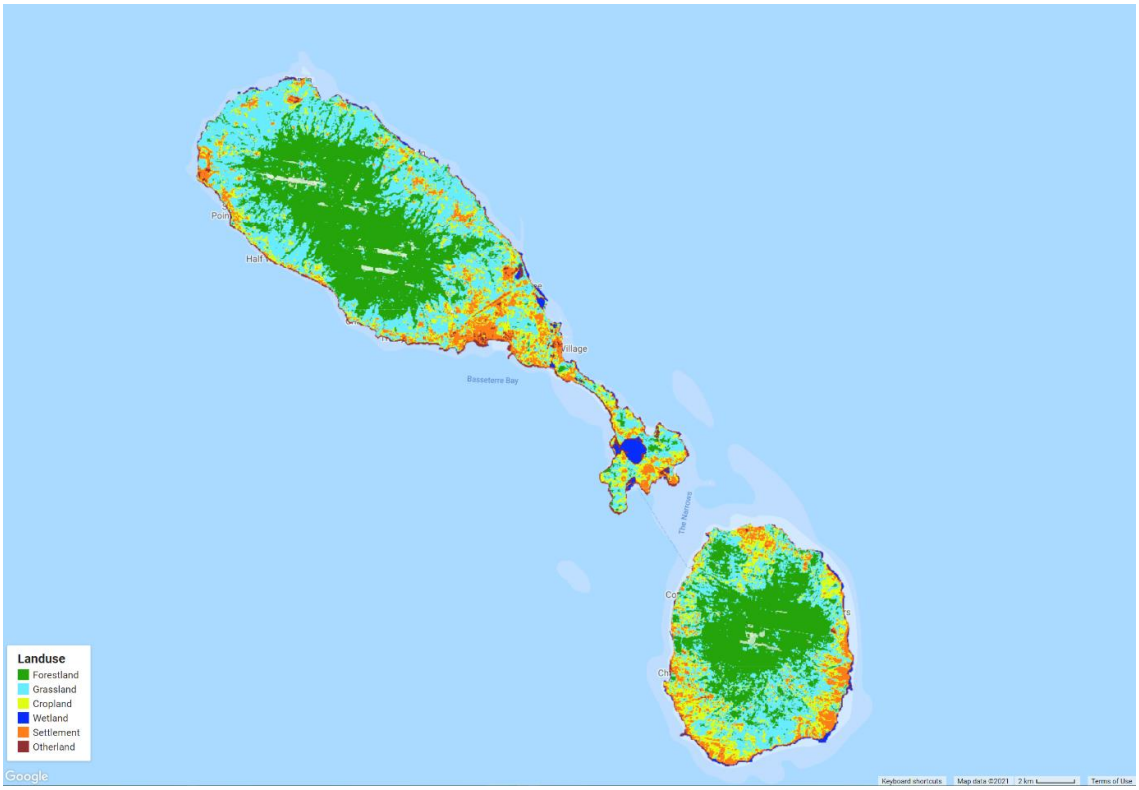
Landsat satellite image 2011

Landsat satellite image 2014

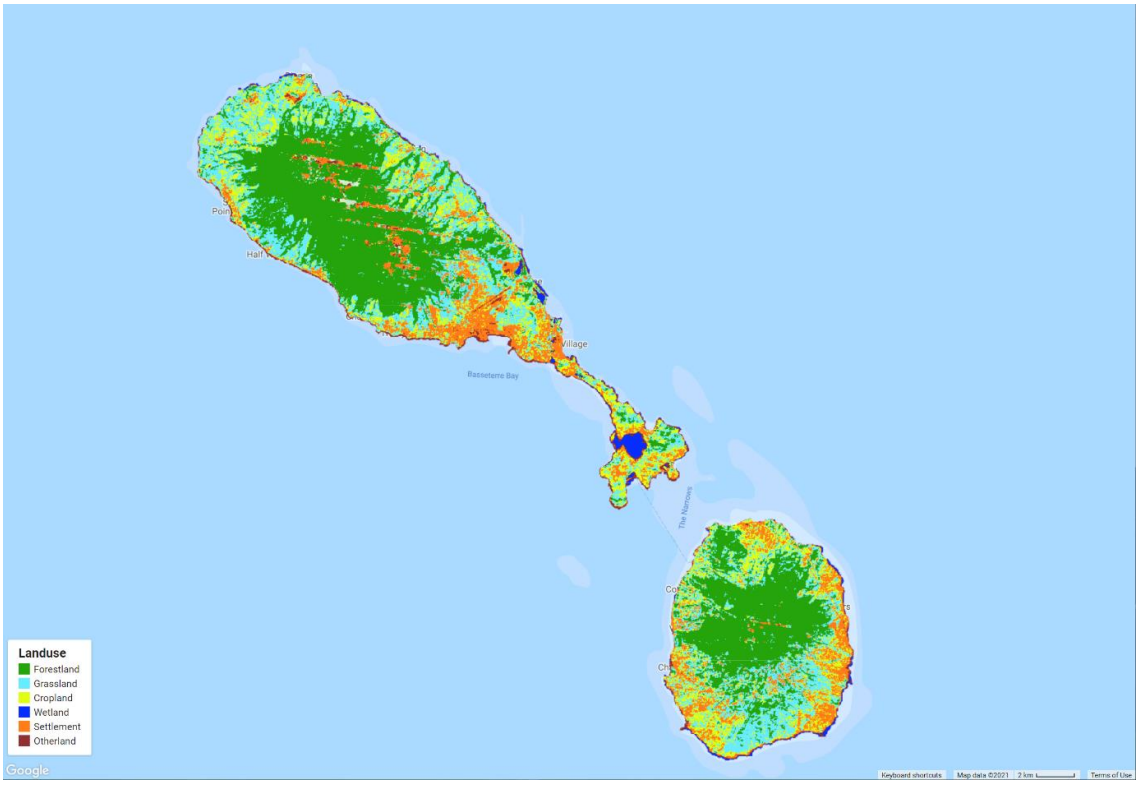
Landsat satellite image 2018



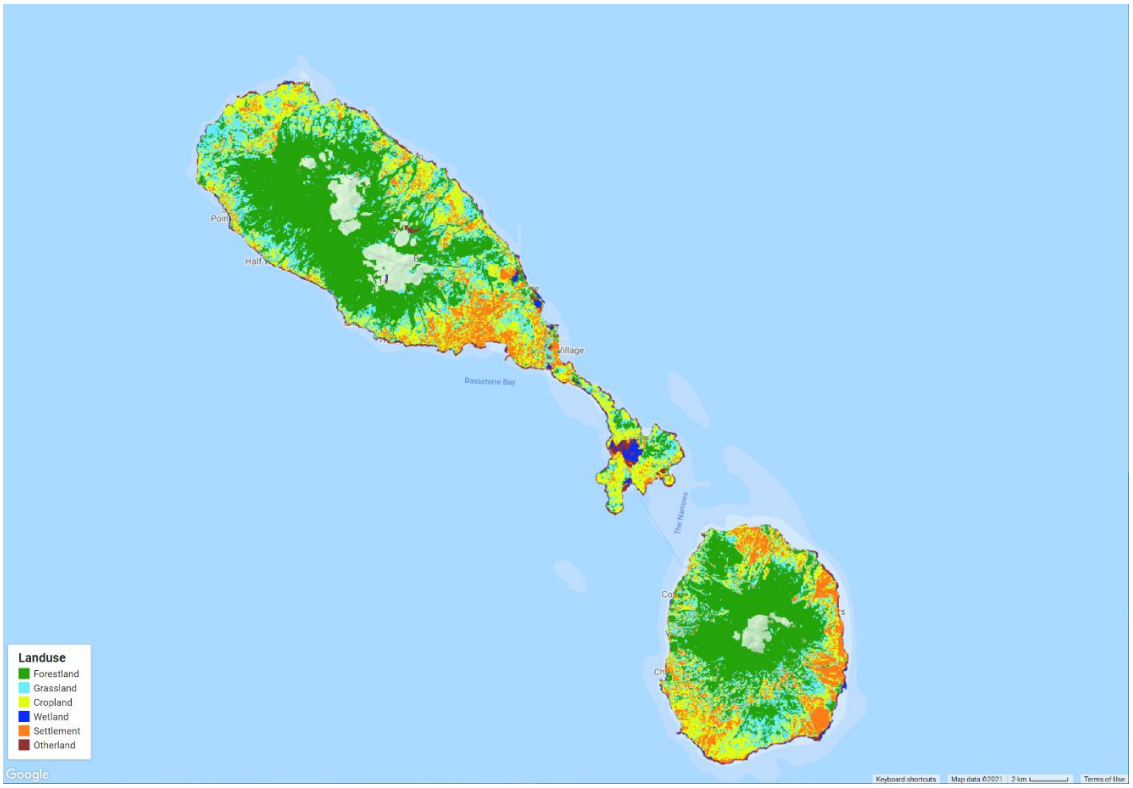
Land use map 2000



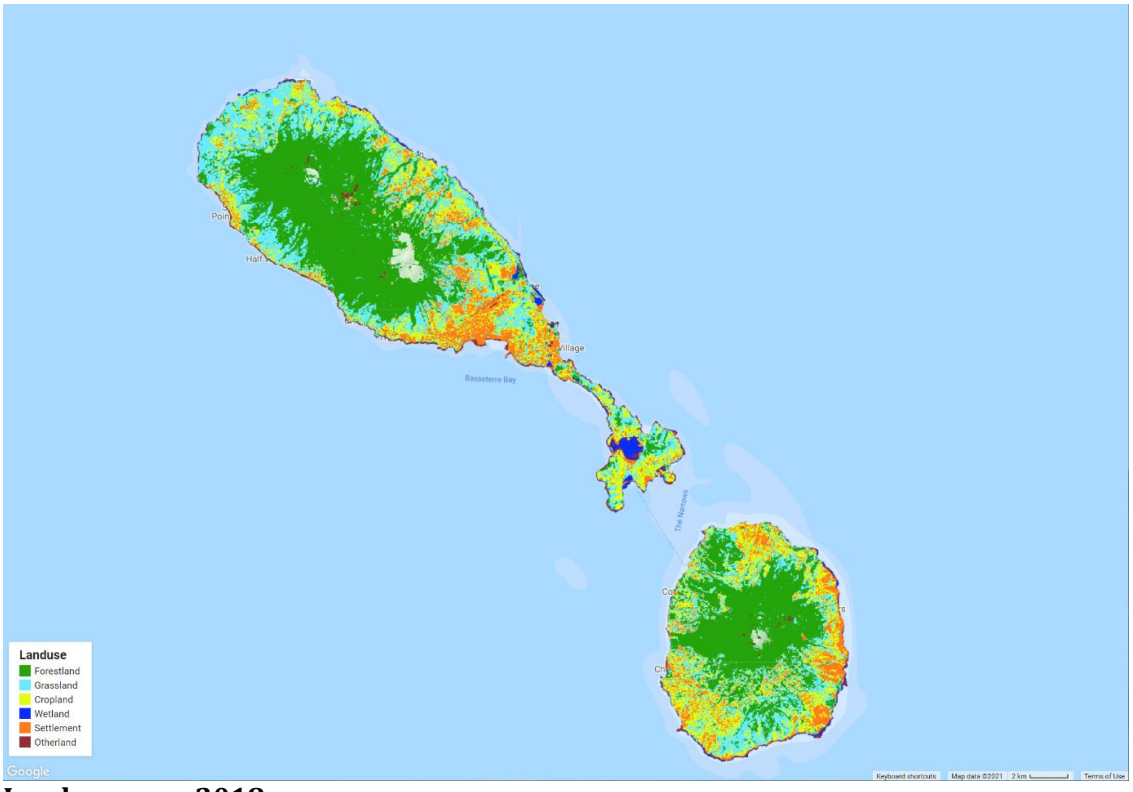
Land use map 2005



Land use map 2011



Land use map 2014



Land use map 2018

Chapter 5 Mitigation Assessment, Action and Effects

4.12 Overview

St. Kitts and Nevis (SKN) is a twin-island federation categorised as a Small Island Developing State (SIDS). Although SKN contributes very little to global warming and climate change, it is extremely vulnerable to the damaging effects posed by these phenomena. From the latest inventory, SKN's total emission with Land Use, Land Use Change and Forestry (LULUCF) was 293.32 $ktCO_2eq$. This represents 0.0006% of the total global emissions in 2018, estimated at 48.94 Gt CO_2eq [1].

Similar to many SIDS, the general focus of the country has been mainly to adapt to the risks and vulnerabilities of the damaging effects of these phenomena, advance the ambitious targets of the twin-island federation to mitigate the release of greenhouse gases, and meet its Paris Agreement goals.

Mitigation efforts are mainly related to advancing the use of renewable energies, improving energy efficiency, and maintaining carbon sequestration potential. While the twin-island federation is encouraging increased sustainable mobility, it recognises that improvements in the power generation sector are of foremost importance. In addition, SKN recognises that mitigation actions identified have many co-benefits associated with human health, energy security, biodiversity conservation, employment, and economic growth, among others.

This chapter on Mitigation Assessment, Action and Effects presents an updated overview of the proposed mitigation actions for SKN from its First and Second National Communications to the UNFCCC.

This chapter covers the following areas:

- Trends in greenhouse gas emissions and removals and key sectors;
- SKN's pathway to reducing emissions;
- Overview of the modelling work, including methodology and assumptions; and
- Summary of the mitigation actions.

4.13 Trends in SKN GHG Emissions and Removals

SKN 2018 National Inventory Report (NIR) quantifies GHG emissions for four of the five IPCC sectors and follows the 2006 IPCC guidelines. Unfortunately, the IPPU sector was not estimated due to data limitations. The SKN 2018 NIR indicates that the top three categories in level assessment for SKN were:

- Energy industries – CO_2
- Land converted to forest land – CO_2
- Road transport – CO_2

In the trend assessment, the top three key categories for SKN were:

- Road transport – CO_2
- Land Converted to other land – CO_2
- Energy industries - CO_2

SKN total GHG emissions increased by 19.7% or approximately 60 $ktCO_2eq$ in 2018 compared to the 2010 levels (excluding emissions/removals from the Land Use, Land Use Change and Forestry [LULUCF]) according to the latest NIR. This increase corresponds to an increase in GHG emissions of 26% in the energy sector over the same period, mainly attributed to the transport sector with an increase of approximately 91% in 2018 from 2010 levels. The energy sector represented 77% and 81% of total GHG emissions in 2010 and 2018, respectively.

Although it is expected that GHG emissions trend, particularly in the energy sector, is expected to trend downward in 2020-2021 due to the impact of the global COVID-19 pandemic, this downward trend is only expected to be maintained for this period, and steady increases will continue post-2021 unless the identified mitigation actions are implemented.

The SKN 2018 NIR also indicates a slightly upward trend of GHG emissions when including the LULUCF sector compared to the 2010 levels (+5% compared to 2010 levels), with a rather stable trend overtime series, driven by the energy sector. Previous emission estimates in LULUCF showed significant fluctuations in the trend, which triggered an improvement action by the SKN. Furthermore, in early 2022, a field assessment was conducted on both islands to address the deficiency of the remote sensing results, and the land use matrix was significantly improved. Consequently, the trend line in the LULUCF sector now covers the whole period of 2008-2018 and is much more consistent with de-facto land use in SKN.

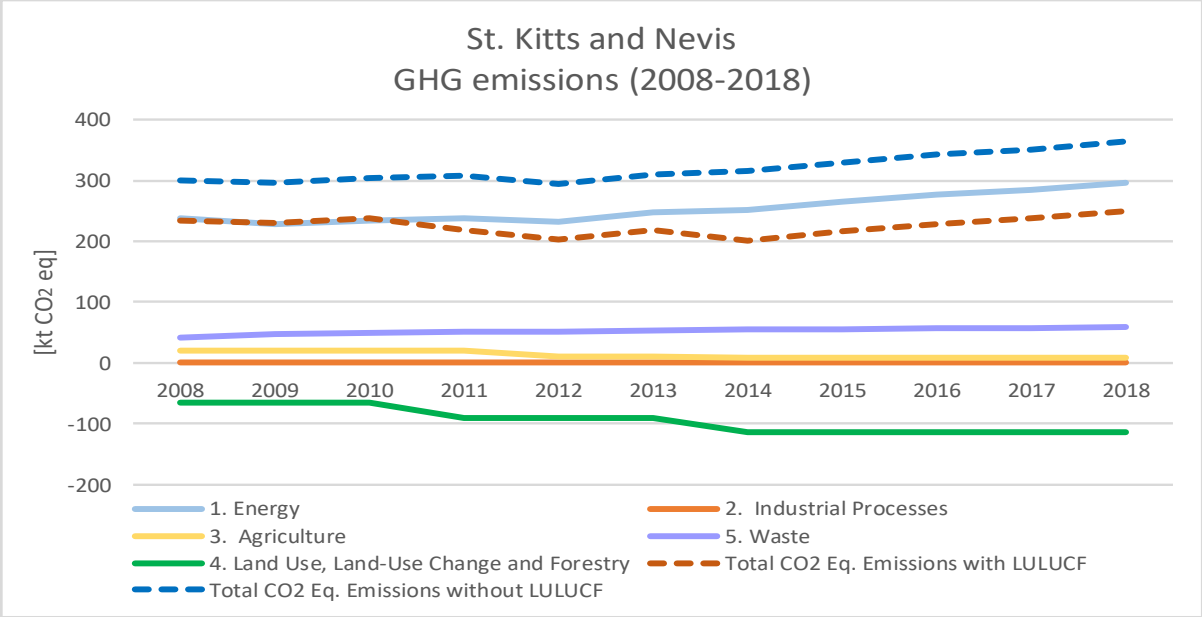


Figure 5.25: Total GHG emissions and removals by sector and total emissions with and without LULUCF (2008-2018)

As shown in Figure 5.25, the total GHG emissions without LULUCF is expected to increase without implementing the identified mitigation actions. This chapter includes a mitigation strategy for SKN that demonstrates potential methods to enable a low emissions development pathway.

4.14 ST. KITTS AND NEVIS EMISSION REDUCTION PATHWAY

International Agreements

St. Kitts and Nevis became a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) on 12th June 1992 and ratified the agreement on 7th Jan 1993. As a SIDS, SKN requirements under the UNFCCC are not obligatory, and the country may submit its Biennial Update Report (BUR) at its discretion to the Conference of Parties (COP). The BUR should contain information on the mitigation actions of the country and expected emission reductions. This information is relevant to the implementation of the Convention, as it enables the Parties to the Convention to be informed of each other's national-level actions and serves as a basis for the COP to assess the Parties' level of implementation and commitments.

SKN became a Party to the Kyoto Protocol on 8th April 2008 and ratified the Doha Amendment to the Kyoto Protocol on 25th October 2016. Although, as a SIDS, SKN has signed the Kyoto Protocol, this agreement only binds developed countries.

In 2011, the Durban Platform for Enhanced Action (ADP) was launched. In this new initiative, all countries would have legal duties to reduce their emissions, unlike the framework defined under the UNFCCC and the Kyoto Protocol. This new binding agreement became what is known as the Paris Agreement. SKN ratified the Paris Agreement on 22nd April 2016. This agreement aims to limit the increase in average global temperature well below 2°, preferable to 1.5°Celsius compared to pre-industrial levels. The Glasgow Climate Pact of 2021 reaffirmed the Paris Agreement.

4.15 St. Kitts and Nevis Nationally Determined Contributions

St. Kitts and Nevis, as part of their commitments under the Paris Agreement, submitted its First NDC on 22nd April 2016 and their updated NDC on 25th October 2021. The NDCs are national climate actions, related targets, policies, and measures to implement in response to climate action and as contributions to global action and operate on a 5-year cycle. The NDCs submitted by SKN are conditional and based upon available financing and technology support.

St. Kitts and Nevis first NDC proposed emission reduction targets of 22% and 35% of the absolute GHG emissions projected in the business-as-usual (BAU) in 2025 and 2030, respectively. These reductions were based on all economic sectors, focusing on the energy and transport sectors [2].

SKN updated NDCs aim to reduce economy-wide CO_2 emissions by 61% by 2030, compared to the base year of 2010 GHG emission levels. This reduction is based on achieving 100% renewable energy in electricity generation and increasing the share of electric vehicles in the vehicle fleet to at least 2%. As a result, SKN anticipates that the emissions will reduce to 124 $GgCO_2$-eq (124 $ktCO_2$-eq) in 2030 within the energy sector [3]. The updated NDC presents an increased ambition for SKN when compared to the first NDC.

4.16 Mitigation Actions and Policies since the Second National Communication

In St. Kitts and Nevis Initial National Communication (INC) [4], the mitigation actions focused on sub-sectors of the residential, transport, and energy industries. Several measures were considered for priority actions in each of the subsectors identified.

SKN submitted their Second National Communication (SNC) in 2015. In the SNC [5], St. Kitts and Nevis did not submit a specific chapter on its mitigation assessment. Nevertheless, some issues were addressed in the technology needs assessment chapter. This chapter identified the need for continued development in the following technologies for electricity generation:

- Wind energy development in Nevis;
- Geothermal energy development in Nevis;
- Biomass energy development from sugarcane production;
- Interconnection between the two islands to facilitate the interchange of renewable energy generation on the twin-island federation.

Since the SNC, there have been several initiatives to reduce GHG emissions in the energy sector and increase carbon sequestration across the twin-island federation. These initiatives are in various execution stages, with some completed and others in the preparatory phase. The initiatives listed below are described in section 4.20 under the relevant action. The major initiatives are highlighted below:

General

- The Climate Change Policy of 2017 outlined the need for mitigation action, including the co-benefits of mitigation such as health benefits and ecosystem restoration [6].
- Assessment of cost-effective mitigation options to inform the update of the NDCs [3].
- Approval of the Global Environment Facility (GEF) 7 Project – Achieving rapid decarbonisation of the Energy sector in St. Kitts and Nevis. This includes the development of a revised energy policy, a roadmap, an investment plan for achieving the energy policy, an energy-efficient building pilot project and improved financing for renewable energy projects [7].

Energy Demand

- Lighting retrofit projects for street lighting.
- Lighting retrofit projects for sporting facilities floodlights.
- Energy audits of public buildings and water pumps.

Electricity Generation

- Commissioning of two solar PV farms of 0.75 MW and 0.5 MW.
- Integrated Resource Plan and Assessment for the Power Sector for the twin-island federation.
- Wind development of 1.9MW in Nevis
- Continued geothermal development in Nevis.
- Approval of a 35.7 MW solar with battery storage.

Transport

- Pilot electric bus project under the Italian government.

IPPU

- Enabling Activities for HFC phase-down and signing the Kigali Amendment with expected ratification of the amendment in 2022. This included a needs assessment for the refrigeration and air conditioning (RAC) sector.

Waste

- Commencement of a recycling project to help reduce waste entering the landfill.

LULUCF

- Concept note to the Green Climate Fund (GCF) for reducing GHG emissions from Forests and Land Use and increasing the resilience of the livelihoods and communities and ecosystems they depend upon.
- Integrated Water, Land and Ecosystems Project (IWECO). One component of this project is the restoration of degraded lands in SKN.

Agriculture

- GEF 6 Project – Improving Environmental Management through Sustainable Land Management in SKN. This project promotes the use of agroforestry techniques and reforestation to increase the potential of carbon sequestration [8].

4.17 OVERVIEW OF MODELLING WORK

Overview of methodology

The mitigation analysis for St. Kitts and Nevis (SKN) was developed using the Low Emissions Analysis Platform (LEAP), [18] a software tool developed by the Stockholm Environment Institute (SEI) and widely used for energy policy analysis and climate change mitigation assessments. LEAP is an integrated, scenario-based modelling tool that can quantify energy consumption and production and resource extraction in all sectors of the economy and under different scenarios. In addition, it allows

[18] https://leap.sei.org/

for the consideration of both sources and sinks of GHG from the energy sector and the non-energy sector.

The model for SKN developed in LEAP simulates the evolution of energy demand and supply in the country, as well as the GHG emissions corresponding to the energy and non-energy sectors, and the mitigation potential of a series of sectoral measures. The model covers the twin-island federation as a single country with some specific details disaggregated by each island in the electricity generation sector. It is important to note that there are two utility companies within the federation, namely Nevis Electricity Company Limited (NEVLEC) and St. Kitts Electricity Company Limited (SKELEC). Although some specific disaggregated data was obtained from both companies for electricity generation, other the data used in model such as the economic data and energy demand was national specific. As such, it was difficult to generate two separate models.

A total of eighteen (18) mitigation actions were identified for St. Kitts and Nevis. These actions were assessed based on data availability and applicability for mitigation modelling. Of these, two (2) actions were considered enabling actions to implement other actions and one action was deemed unsuitable for modelling due to lack of data availability. As a result, fifteen (15) mitigation actions were modelled in LEAP.

The model covers the historical period 2008 to 2018, harmonious with the dates provided in the NIR. The model reflects the most recent economic, demographic and energy statistics and has been aligned to closely resemble the NIR data (within 0.3% of the total net emissions in 2018). The projections period commences in 2019 with forward-looking scenarios created for 2030, 2035 and 2050. The projection period uses GDP and population growth projections as the main drivers of energy demand and, to the extent possible, captures the estimated economic impact of COVID-19. Energy consumption has been disaggregated by sector and fuel, including residential, transportation, industrial, services, agriculture and fisheries, and other unspecified sectors. These projections have been supplemented by more detailed modelling of the transportation sector, which includes a breakdown of the transport mode (rail and road), type (passenger and freight), vehicle type (e.g., cars, motorcycles, buses, etc.) and technology (e.g., internal combustion engines, hybrid, and electric vehicles). On the demand side, projections are based on historical energy balances, trends, and expected economic and demographic growth. On the supply side, the model represents power generation in terms of capacity expansion and dispatch of power plants for each island system but with joint transmission and distribution losses. The non-energy sector encompasses the emission categories from the inventory: fugitive emissions, agriculture, land use and land-use change (LULUCF), and waste.

Three future scenarios were developed to assess GHG mitigation potential: a baseline and two mitigation scenarios as described further below. Emissions were projected for each of the three scenarios, and the results were compared under the various scenarios. The mitigation effects reported in this chapter are referred to as emissions reductions by comparing the baseline scenario to the mitigation scenarios.

The three scenarios developed for St. Kitts and Nevis are:

- **Baseline** illustrates the expectations of emissions in St. Kitts and Nevis, assuming no changes in the policy actions from 2018 and considering a continuation of the current trends in demographic and macroeconomic drivers, as well as in sectoral energy intensity. It considers modest energy efficiency improvements, which can be expected even without government policies. The supply-side assumes that diesel generators meet additional power generation capacity requirements. The baseline scenario is used as the counterfactual scenario to estimate emission reductions achieved through the implementation of mitigation measures.

- **Mitigation** uses the same macroeconomic and demographic assumptions as the baseline and implements the mitigation actions and assumptions highlighted in section 4.20.2.

- **Additional Mitigation** includes the same assumptions and mitigation actions as above but also explores higher integration of electric and hybrid vehicles, increased use of public transportation and the decoupling of the transport sector from the GDP of the country.

By building the model for SKN mitigation assessment analysis within LEAP, the model is readily available for future updated mitigation assessments. In addition, in-country experts were trained in using LEAP to ensure that the government institutionalises the capacity to use this model.

A stakeholder validation workshop was held to review and validate the assumptions, analysis, and conclusions of the SKN Mitigation Assessment developed in LEAP. The final model reflects the feedback from stakeholders at the validation workshop.

4.18 Modelling assumptions

4.18.1 Baseline Scenarios

The baseline scenario corresponds to the counterfactual scenario used to compare emissions and estimate mitigation potential for the modelled actions. The baseline scenario explicitly does not consider the targets, goals, and projects of the mitigation strategy. Rather, the scenario reflects a continuation of existing trends and modest energy efficiency improvements of 0.5% per year in the residential, services, and industry sectors. The baseline also considers shifts in technologies that are expected to happen even without new policies, for example, increasing the use of electric appliances over other fuels in the residential and services sectors.

In the baseline, future emissions are estimated based on modelling the energy demand, supply, and non-energy sectors. These projections are driven by historical trends in energy consumption and projected macroeconomic indicators, such as population, number of households, GDP, and GDP per capita. The estimates of historical total energy consumption and trends were mainly based on energy balances produced from the latest inventory report. For the transport sector, this data was supplemented by national vehicle registration information, which allowed for more detailed modelling of the vehicle fleet, including diverse types of passenger and freight vehicles such as cars, motorcycles, SUVs, pickup trucks, minibuses, buses, taxis, vans, and trucks. The bottom-up fuel

consumption projections were calibrated to align with historical transport sector energy requirements. The baseline does not consider the introduction of hybrid and electric vehicles in the future fleet.

For the projected period, the baseline presented corresponds to the best available realistic projection of future emissions based on current trends and market influences. In the energy sector, GDP is the key driver used for the baseline energy demand and GHG emissions projections in the residential, services, transportation, and industrial sectors. The demand and emissions in the residential sector are driven by the increasing number of households in the country, which relate to the expected population growth. In the electricity generation sector, no further additions of renewable capacity are considered from the 2018 levels (0.5 MW of solar in St. Kitts and 1.93 MW of wind in Nevis), which results in 97-100% of electricity generated from diesel power throughout the modelling period. The retirement of existing diesel generators is indicated as planned by the utility companies for 2023 and 2025. All other generation capacity is retired based on a 25-year lifetime for diesel generators and a 30-year lifetime for solar and wind capacity. All of the additional electricity generation capacity requirements are met through new diesel generators.

In the non-energy sectors, the fugitive emissions and emissions from the agriculture sector were also projected based on GDP growth, while emissions from the waste sector followed the same growth as the population. The sequestration potential of the LULUCF sector is expected to remain constant from 2018 levels.

4.18.2 Mitigation Scenarios

In the mitigation scenarios, 15 mitigation measures were modelled in LEAP, which corresponds to actions implemented in the residential, services, transportation, electricity generation, waste, and LULUCF sectors. A detailed description of the measures and specific modelling assumptions is provided in section 4.20. The two mitigation scenarios described in section 0 consider the simultaneous implementation of the measures included in each scenario, accounting for possible interactions between measures. For example, the mitigation potential of the electrification of the transport sector is enhanced by the higher uptake of renewable energies in the power generation sector. On the other hand, the estimated mitigation potential of energy efficiency measures would be different if the power generation is based on diesel generators or renewable energy.

The policy measures in the residential and services sectors were represented as expected energy savings, estimated outside of LEAP based on the technical characteristics, uptake rates, and other assumptions as described in section 4.20. In the transportation sector, the bottom-up modelling of the different transport modes and vehicle types allowed for modelling sectoral mitigation actions and the resulting energy and emissions savings directly in LEAP. The measures in the power generation sector include planned additions of renewable capacity and a reduction in transmission and distribution losses in both islands. The LEAP model estimates projected electricity requirements and power generation capacity and dispatch from different types of power plants on each island.

4.19 GHG emission projection results

4.19.1 Baseline Scenario emissions projections

Based on projections from United Nations World Population Prospects [9], the total population in St. Kitts and Nevis (Figure 5. 26a) is expected to grow from 53.2 thousand in 2020 to 55.8 thousand in 2030 and 56.5 thousand in 2035. The population is expected to decline to 56.2 by 2050. The total number of households (Figure 5. 26b) is expected to increase from 23.5 thousand in 2020 to 25.4 thousand by 2030 and 25.5 thousand in 2050. In terms of economic growth (Figure 5.27), near term projections from the International Monetary Fund (IMF) World Economic Outlook were used until 2025 [10]. These projections consider the impacts of COVID-19 on GDP, where a decrease of 14.4% in the GDP for 2020 was estimated. From 2025 to 2050, national-level GDP growth rates from the Shared Socioeconomic Scenarios database (SSP2= "Middle of the Road") were used [11].

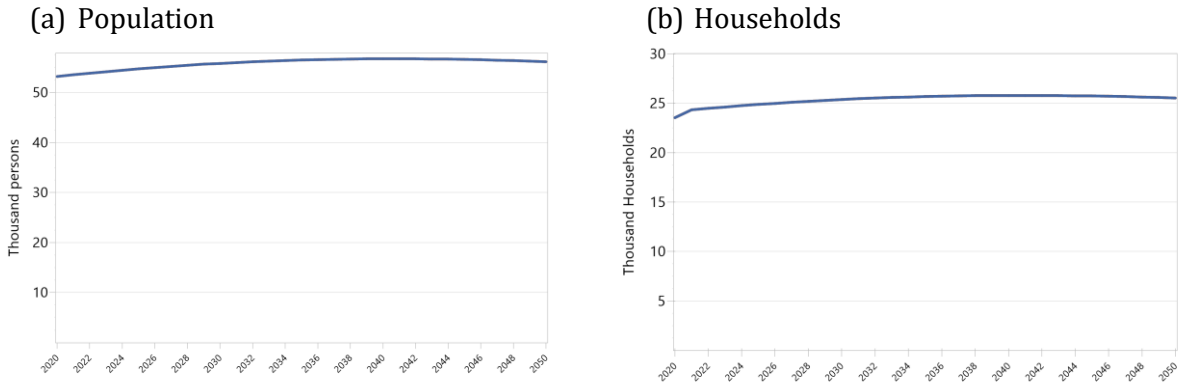


Figure 5. 26. Population (a) and household (b) trends to 2050

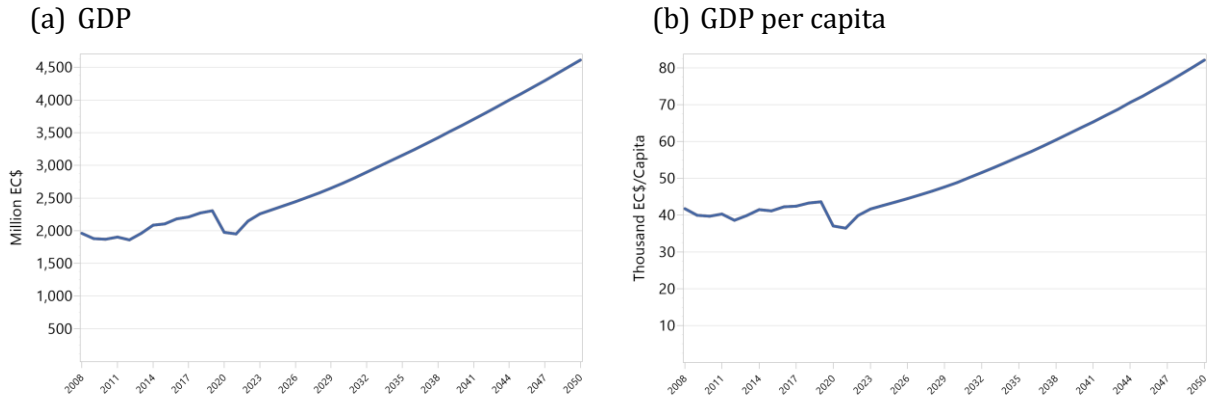


Figure 5.27. GDP (a) and GDP per capita (b) trends to 2050

Figure 5.28 and Figure 29 show baseline emission projections for all sectors and gases. For the historical period 2008-2018, emissions are closely aligned with the most recent GHG inventory for St. Kitts and Nevis. Total emissions for 2008, 2010 and 2018 were estimated at approximately 238.25 $ktCO_2$ eq, 240.60 $ktCO_2$ eq and 251.07 $ktCO_2$ eq respectively. For the prospective period, the baseline presented corresponds to the best available realistic projection of future emissions based on current

trends and market influences. The total net projected emissions reach 343.13 $ktCO_2$ eq by 2030, 391.27 $ktCO_2$ eq by 2035 and 536.05 $ktCO_2$ eq by 2050.

Around 71% of the total net emission in 2018 corresponds to CO_2. As observed, electricity generation and transport sectors are the most carbon-intensive sectors, contributing to 48% and 32% of the total emissions in 2030. The LULUCF sector is an important emission sink, contributing to the sequestration of 113.1 $ktCO_2$ eq, representing 25% of the total emissions in 2030.

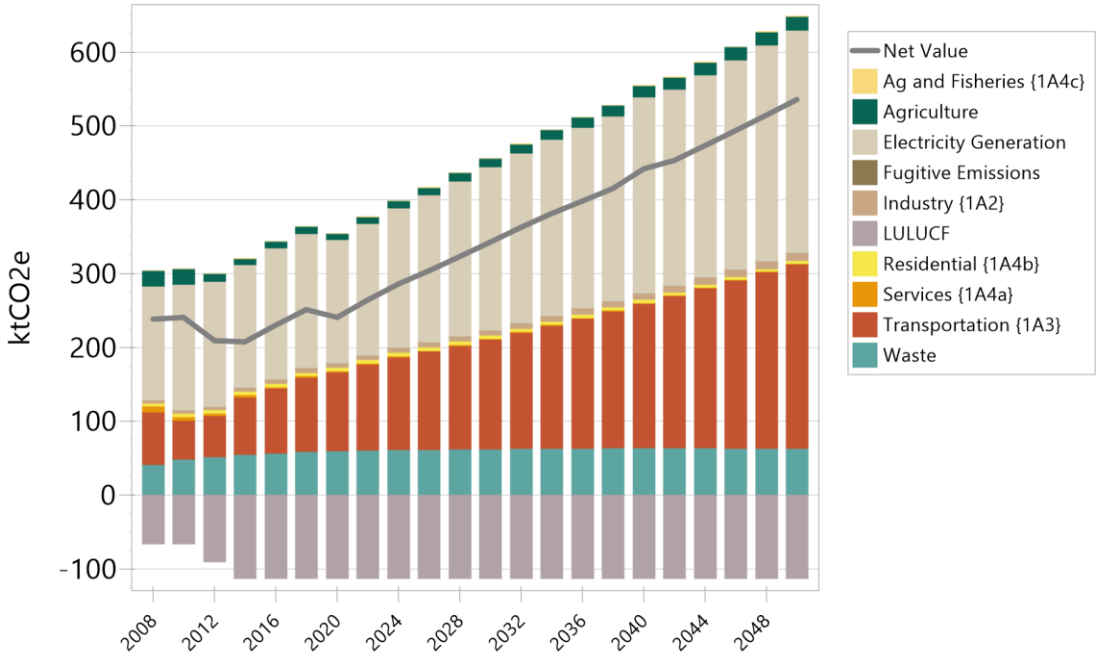


Figure 5.28. Projected GHG emissions in the baseline by sector

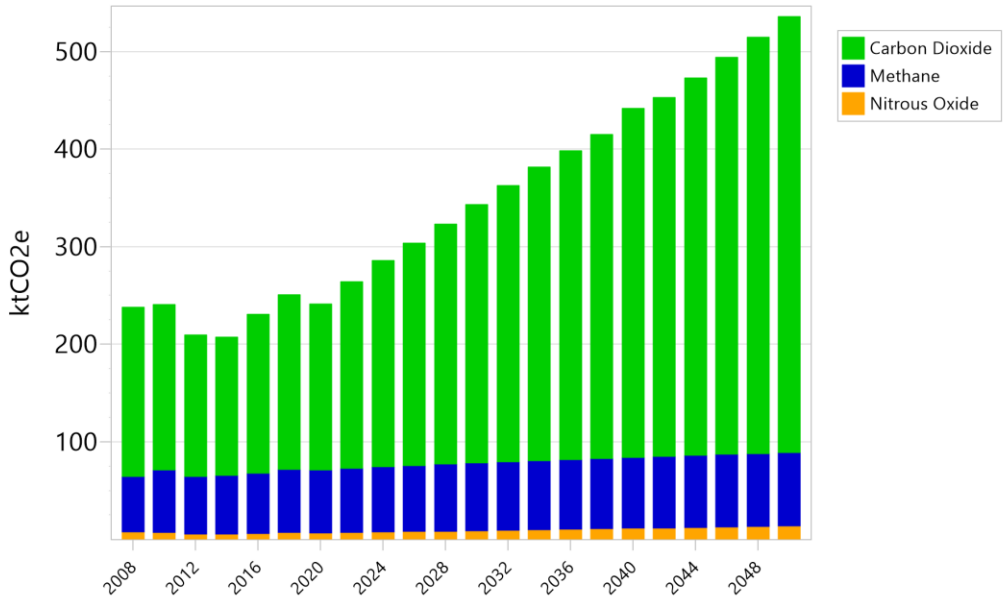


Figure 29.5 Projected net GHG emissions in the baseline by gas

4.19.2 Mitigation scenarios

As discussed in section 5.6, two mitigation scenarios were modelled, which have the same demographic and macroeconomic assumptions as to the baseline, and consider a series of mitigation actions, detailed in section 5.9. The scenario with additional mitigation actions explores all of the measures in the mitigation scenario, with higher integration of electric and hybrid vehicles, increased use of public transportation and the decoupling of the transport sector from the GDP of the country.

Figure 5.30 shows the results of the total net emissions in the three modelled scenarios and the NDC target for 2030 as reference. As observed, the scenario with the current mitigation actions reduces 34% by 2030 and 44% by 2035 compared to the 2010 value (240.6 $ktCO_2e$). By 2035, the scenario with additional mitigation actions results in a 57% reduction compared to 2010 levels.

Figure 5.31 and Figure 5.32 show the total net emissions by sector and gas, respectively, in 2010, 2020, 2030 and 2035 for the three scenarios. Figure 5.33 and Figure 5.34 show the emission reductions by sector in the scenario with the current mitigation actions and additional measures compared to the baseline scenario. The largest emission reductions occur in CO_2 emissions from the power generation sector, which will reach practically zero by 2035. By that same year, the transport and waste sectors are responsible for the majority of the remaining emissions, while the LULUCF sector continues to act as an important emissions sink.

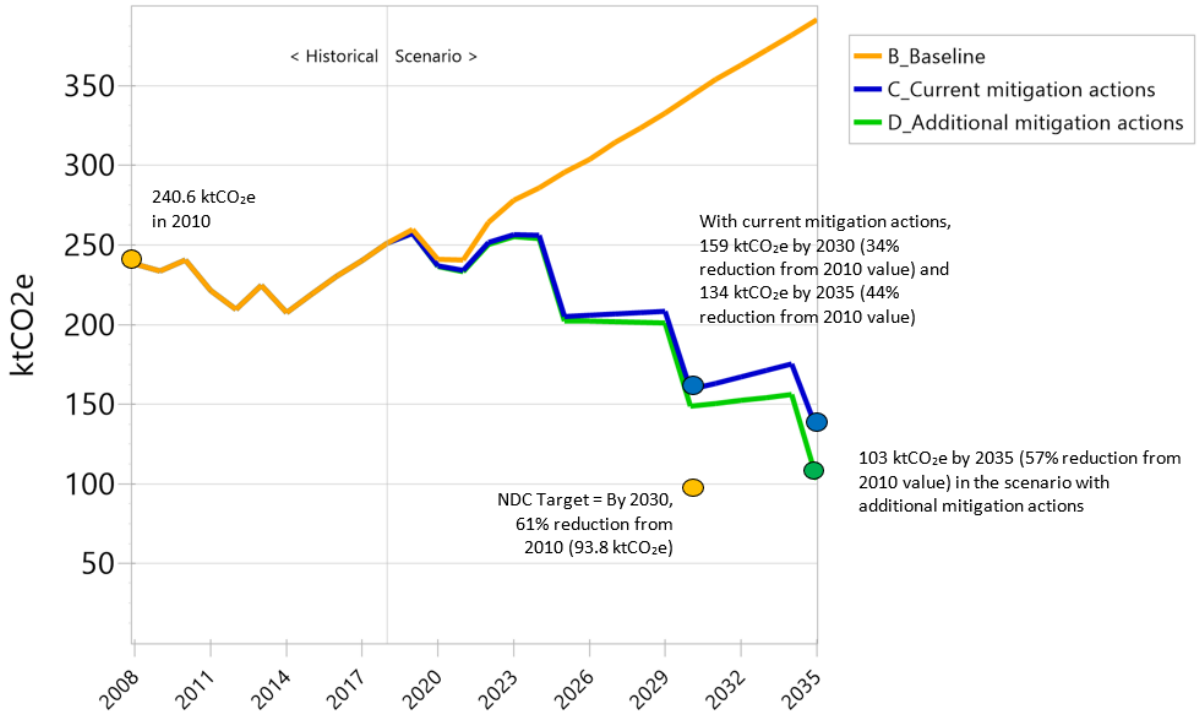


Figure 5.30. Projected total net emissions in St. Kitts and Nevis under three scenarios

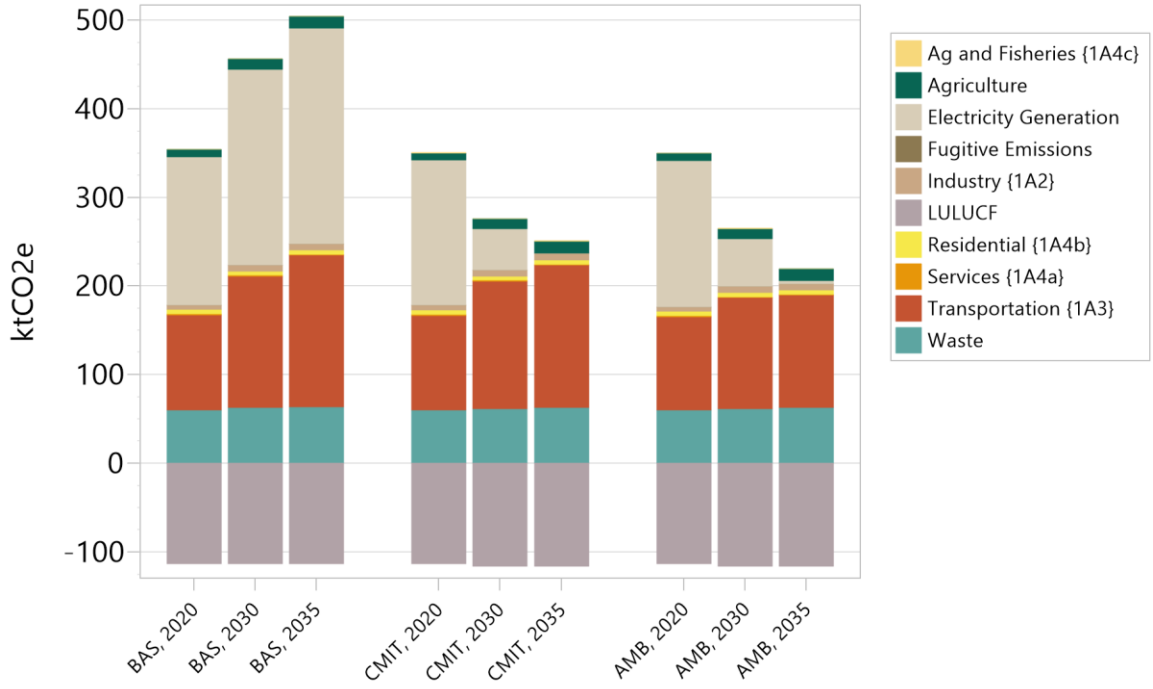


Figure 5.31. Projected total net emissions by sector under three scenarios

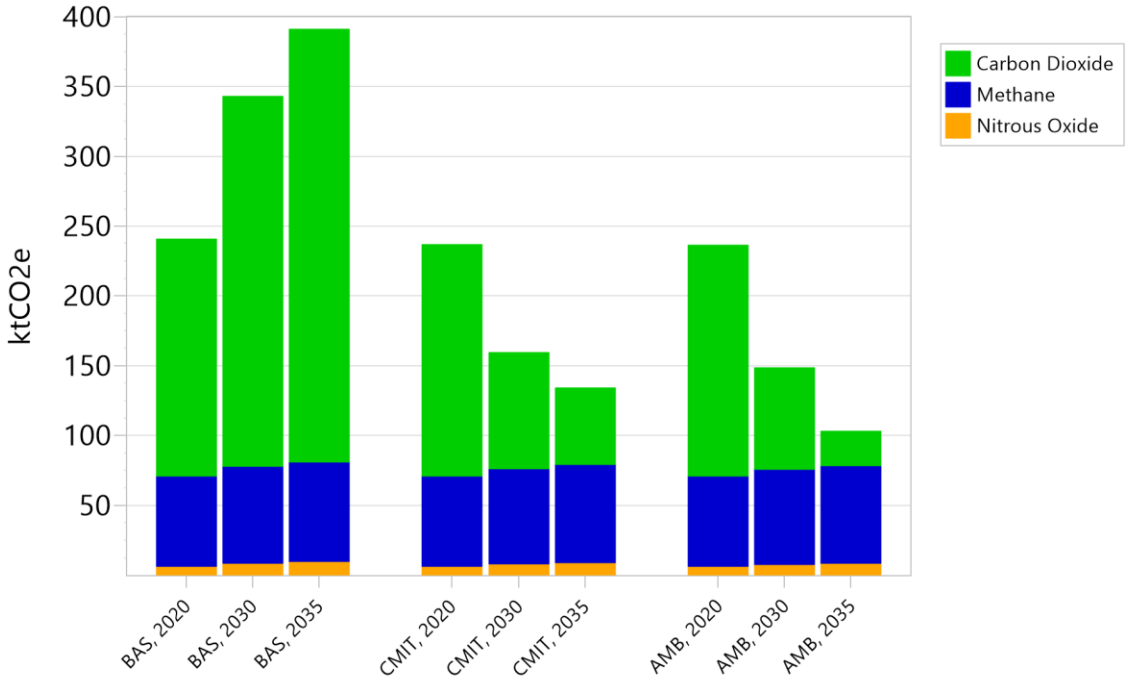


Figure 5.32. Projected total net emissions by gas under three scenarios

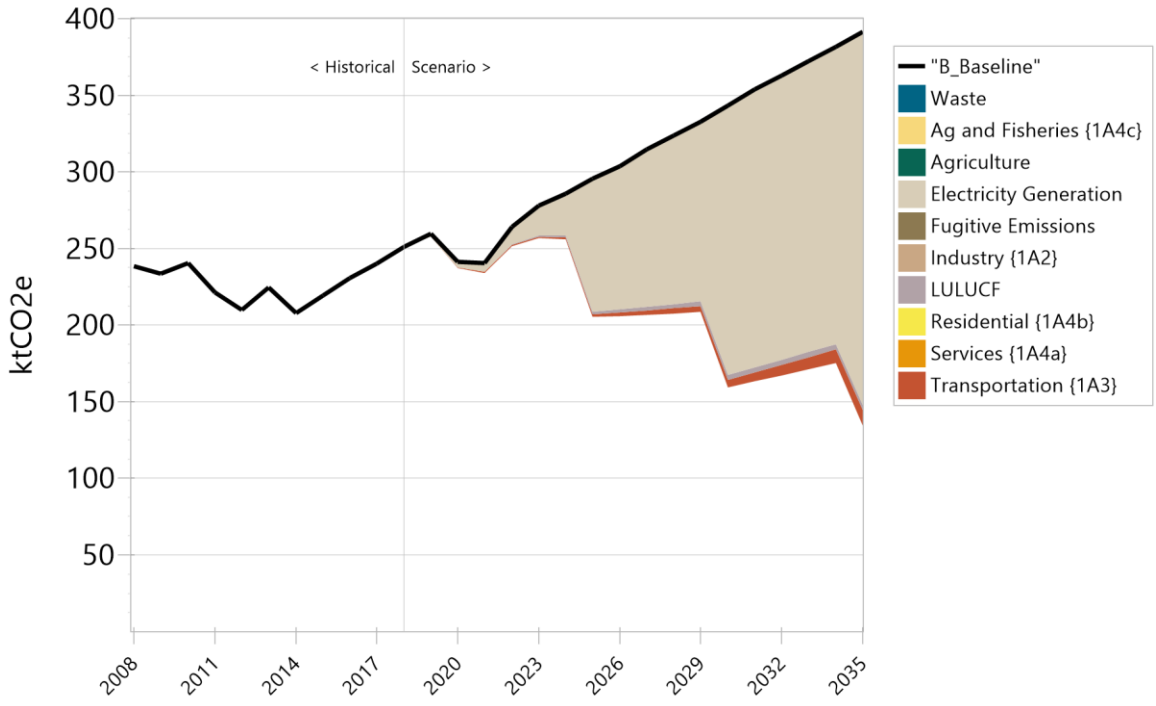


Figure 5.33. Projected emission reductions by sector in the mitigation scenario compared to the baseline

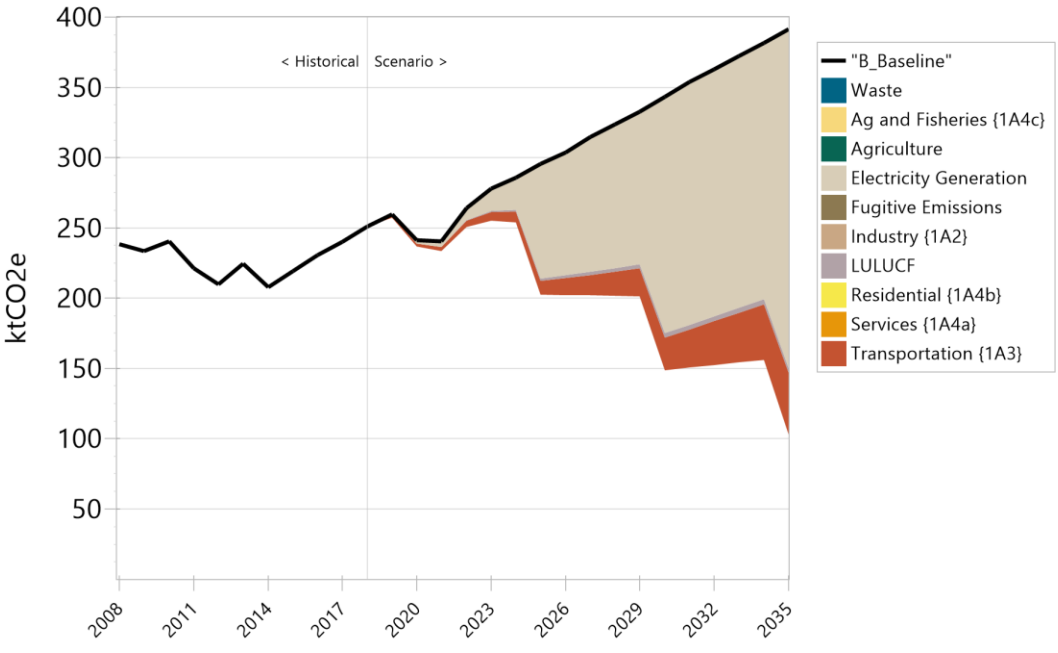


Figure 5.34. Projected emission reductions by sector in the mitigation scenario with additional actions compared to the baseline

Figure 5.35 and Figure 5.36 show the current and projected power generation capacity (MW) and power generation (GWh) by technology for the three modelled scenarios. In the baseline, the installed capacity by 2035 is 61 MW, with 4% of renewable capacity. In terms of power generation, 98% of the total electricity is produced from diesel generators. In the mitigation scenarios, the renewable energy capacity by 2035 includes 36.2 MW of solar, 8.5 MW of wind, and 25 MW of geothermal, which results in nearly 100% renewable generation, pushing back by five (5) years the NDC target of reaching 100% renewable generation by 2030.

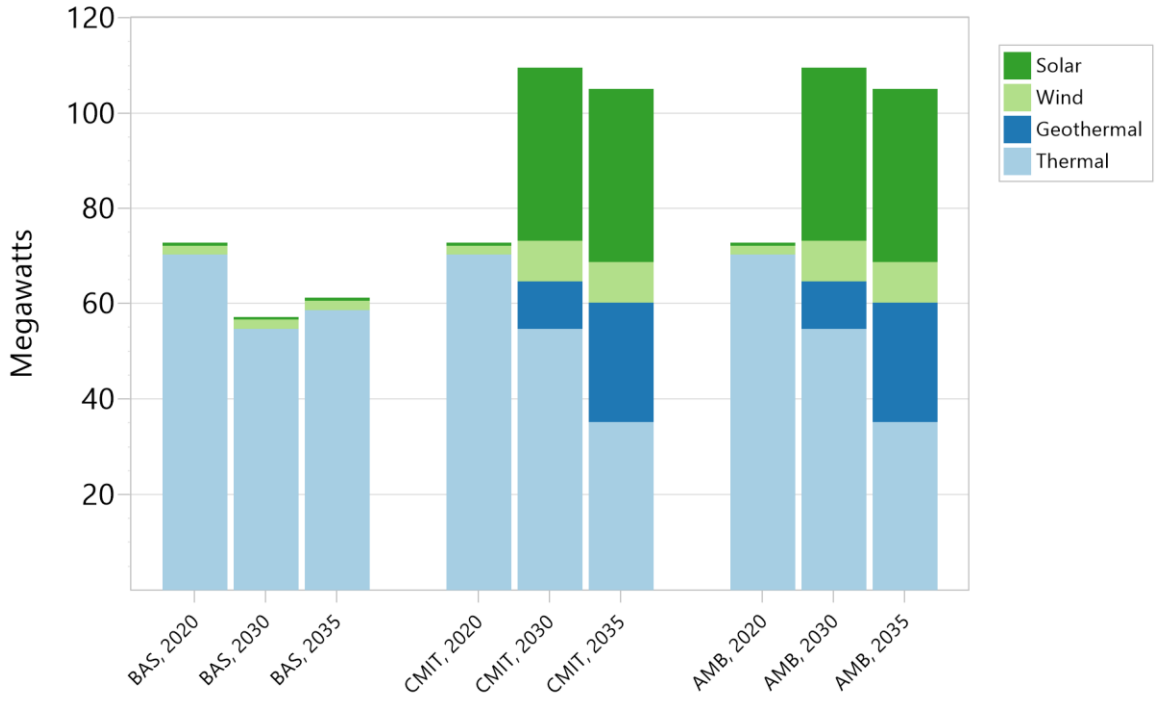


Figure 5.35. Current and projected power generation capacity under three scenarios

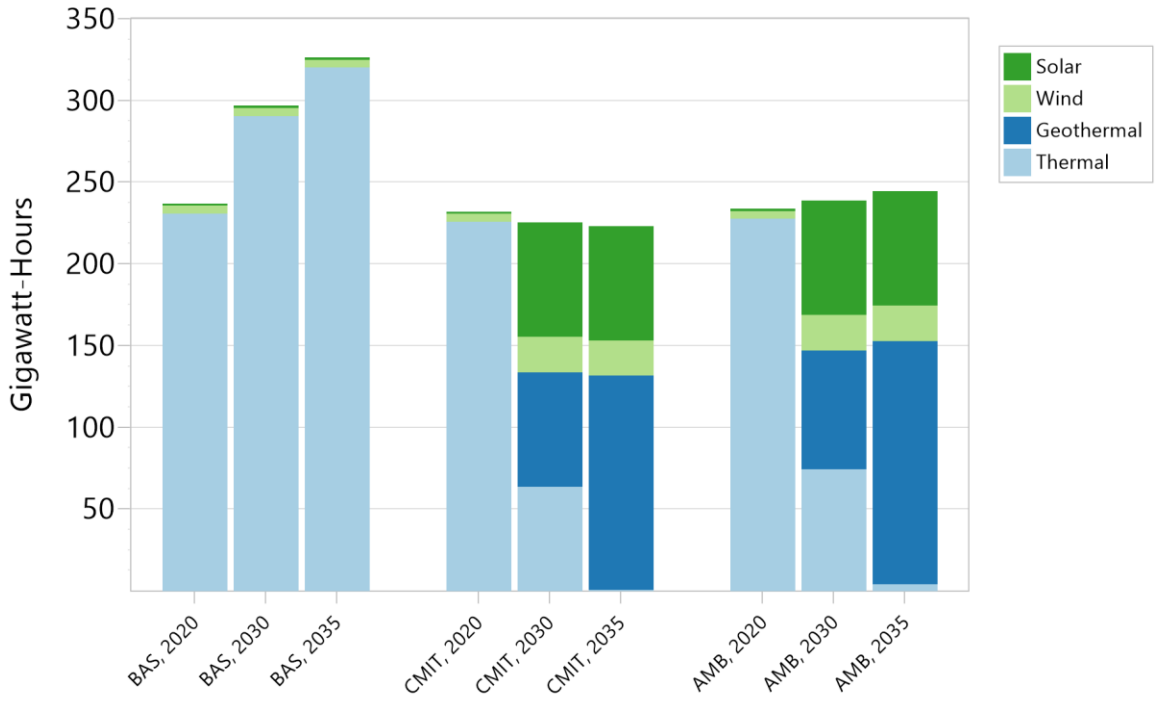


Figure 5.36. Current and projected power generation under three scenarios

Figure 5.37 shows the projected net emissions by 2050, assuming an increasing share of electric and hybrid vehicles as described in section 4.20 below. All additional power generation capacity requirements after 2035 are met by new solar and wind technologies. Without additional measures in the transport sector, the total net emissions in the scenario with current mitigation actions increases after 2035. Higher ambition in this sector could result in overall constant emissions between 2035 and 2050.

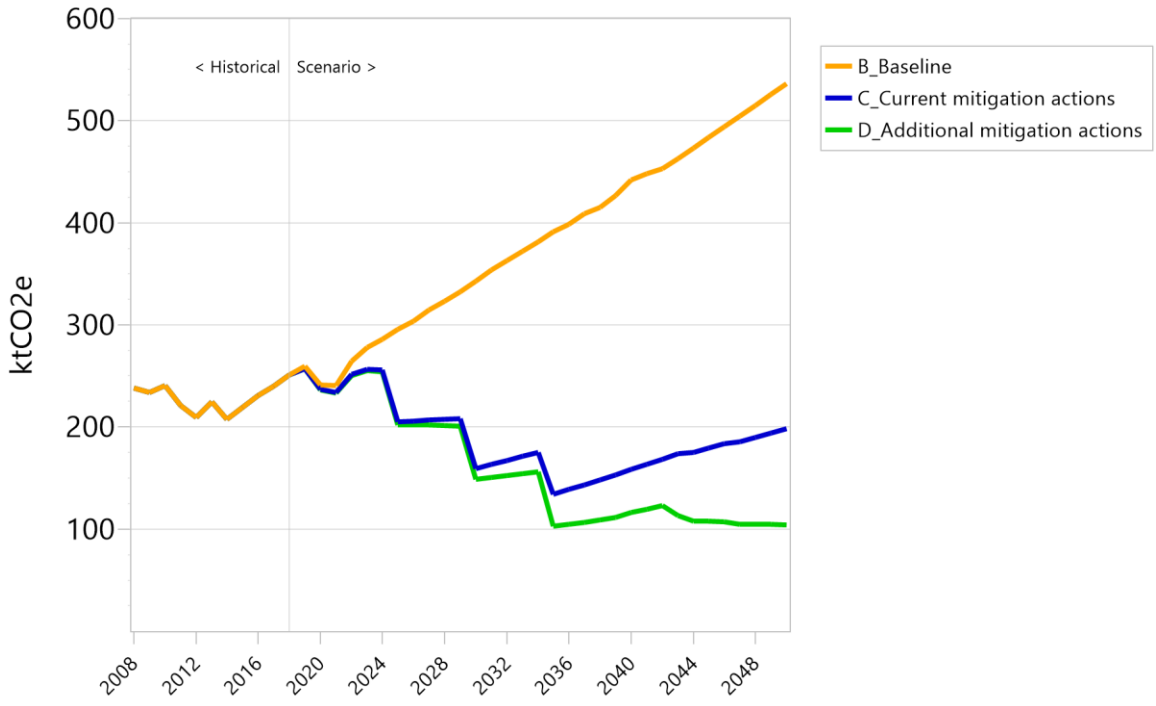


Figure 5.37. Projected total net emissions in St. Kitts and Nevis under three scenarios by 2050

The data for Figures 5.2-5.13 can be found in the Annexes.

4.20 SUMMARY OF MITIGATION ACTIONS

4.20.1 Overview

This section provides a comprehensive overview of the mitigation actions identified by St. Kitts and Nevis and those assessed in the mitigation analysis. Although these actions and measures are described in section 5.9.2, these actions were developed and analysed based on extensive stakeholder consultations. Some actions included in this section were not assessed during the mitigation analysis due to several factors – including, but not limited to – data limitations, the type of action, such as an enabling action which is necessary to implement other actions and limitations of the software used.

The mitigation actions for St. Kitts and Nevis cover the majority of the sectors. A total of 18 mitigation actions have been identified. Although there was no baseline information provided for the IPPU sector, a mitigation action was included with the expectation that improvements in the inventory will allow for this action to be assessed in future years. The mitigations actions because of changes in methodology, end dates, and the structure of the mitigations action; the 61% emissions reduction of the NDC was not met.

Energy Sector

Mitigation actions in the energy sector include sub-sectors of energy demand, electricity generation and transport.

Energy demand incorporates the end-use consumption of energy in St. Kitts and Nevis. This comprises energy demand for residential buildings, commercial buildings (public buildings, schools, churches, restaurants, hotels), industry, and street light use. Mitigation actions for energy demand primarily relate to the affected changes in the end-use of electricity and fossil fuels. These actions are normally related to changes in fuel and/or equipment used for lighting, cooling, refrigeration, cooking, water heating, and other appliances. Reductions in demand in the electricity sector due to mitigation actions in energy demand are normally considered indirect emissions reductions as the changes occur mainly in the electricity generation sector. The GHG impacts can be both changes in supply and improvements in energy efficiency.

Electricity generation encompasses the supply of electricity from centralised and distributed generation. Although, in this assessment and reporting, off-grid electricity is not assessed as currently no system is developed to monitor off-grid system installation accurately. Mitigation actions for electricity generation are generally related to increasing renewables and improving transmission and distribution networks.

The transport sub-sector includes energy-use of diesel and gasoline in road transport and the rail line used mainly for touristic purposes. The mitigation actions in this sub-sector include the increased electrification of the private and public transport system, encouraging the modal shift from private to public transport with enabling actions such as installing charging infrastructure for electric vehicles and incentives to encourage the uptake of electric.

Non-Energy Sector

The non-energy sector includes IPPU, LULUCF, Agriculture and Waste sectors.

The IPPU sector was not included in the latest NIR due to limited data availability, and therefore a baseline was not established for the sector. Nevertheless, a mitigation action was identified based on ongoing work, which will help improve future inventories and simultaneously work towards reducing emissions in the sector. SKN has begun the process to sign the Kigali Amendment of the Montreal Protocol which aims to phase down the consumption and production of HFCs and replace them with more environmentally friendly alternatives. The government is currently gathering the necessary data and conducting an assessment to ratify the agreement and start implementation.

The Agriculture and LULUCF sector include anthropogenic GHG emissions and removals by sinks that occur on managed lands. The mitigation actions for the LULUCF sector include reforestation and agroforestry, which were all placed in one action.

The Waste sector mitigation action aims to reduce the solid waste entering the landfill through recycling and composting methods. This action is expected to reduce emissions to landfills.

4.20.2 Detailed Mitigation Actions to reduce greenhouse gas emissions

Table 5.23: Summary of the Mitigation Actions and emissions reduction potential by 2030

Number	NAME of Action	Potential Emission Reduction in $ktCO_2eq$
Mitigation Action 1	Increase the adoption of solar water heaters	5.54
Mitigation Action 2	Energy efficient measures resulting in a 20% reduction in energy demand	34.22
Mitigation Action 3	Streetlighting retrofits	3.99
Mitigation Action 4	Retrofit of floodlights at sporting facilities	1.07
Mitigation Action 5	Implementation of measures identified in energy audits of public buildings and pumping stations	4.31 -Energy Efficiency measures 5.3 - distributed generation
Mitigation Action 6	Transition to 100% renewable energy	129.15
Mitigation Action 7	35.7 MW of utility-scale solar PV capacity for St. Kitts with 44.2 MWh lithium battery storage	Modelled with Mitigation Action 6
Mitigation Action 8	6.6 MW of wind power capacity in St. Kitts	Modelled with Mitigation Action 6
Mitigation Action 9	15 MW of geothermal power capacity in Saint Kitts	Modelled with Mitigation Action 6
Mitigation Action 10	10 MW in geothermal power in Nevis	Modelled with Mitigation Action 6
Mitigation Action 11	Improve efficiency in transmission and distribution of electricity	20.24
Mitigation Action 12	Electricity interconnection system for the two islands	Not Modelled
Mitigation Action 13	Development of electric vehicles charging infrastructure by 2030	Not Modelled
Mitigation Action 14	2% of the total number of vehicles are electric vehicles, and 2% of the total number will be hybrid by 2030	+0.03
Mitigation Action 15	Public transportation expansion and improvement for a shift of 20% from personal cars and SUVs after 2025	1.67
Mitigation Action 16	10% phase-down of HFC	Not Modelled
Mitigation Action 17	Reduction of landfill waste by 2% through recycling and composting systems	0.98
Mitigation Action 18	Increase of 3% of carbon sinks through reforestation and related practices	3.40

Total	Note: The sum of all the individual measures is not the same as the mitigation measures achieved through the simultaneous implementation of the measures because of the interactions between some of the measures. The total represents the sum when simultaneously implementing the measures.	**183.76**

Table 5.24: Mitigation Action 1: Increase the adoption of solar water heaters

Name of the mitigation action					
Increase the adoption of solar water heaters					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Energy Unit/ Ministry of the Environment	2021 – 2030	Energy Demand	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To increase the adoption of solar water heaters					
Brief description					
Fossil fuels currently dominate the St. Kitts and Nevis energy mix. Although the current penetration is low, water heating is mainly done through electrical water heaters. The promotion of solar water heaters will assist in the increased adoption of this technology on the islands. This can be achieved through education and awareness campaigns as well as the introduction of incentives for solar water heaters. The energy unit for SKN participates in CARICOM energy awareness month activities in November each year.					
Steps to achieve mitigation action					
1. Develop a comprehensive awareness and education plan to promote solar water heaters. 2. Develop a suite of incentives for solar water heaters to encourage uptake and encourage business development in the twin-island federation. 3. Implement projects with the use of solar water heaters on public buildings.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: 1. Increased uptake of solar water heaters. 2. Reduced demand in the power sector. The estimated GHG emission reduction related to the implementation (when implemented alone) is 5.54 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. The number the assumptions made in the model are the following: • Water heaters are either solar or electric.					

• The ownership rate for residential water heaters is assumed to grow from 15% in 2020 to 30% in 2030 and 50% in 2050. The fraction of solar water is expected to increase from 2.5% in 2020 to 40% in 2030 and 70% in 2050. • The ownership of commercial water heaters is assumed to be 10% and remains constant through the years. • Approximately 1% of these water heaters are solar in 2020, and this is expected to increase to 40% by 2030 and 70% by 2050.
Progress indicators
% increase in solar water heater penetration # new solar water installed # projects implemented to install solar water heaters in public buildings
International Market Mechanisms
None

Table 5.25: Mitigation Action 2 – Energy Efficient measures resulting in a 20% reduction in energy demand

Name of the mitigation action					
Energy Efficient measures resulting in a 20% reduction in power demand					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Energy Unit/ Ministry of the Environment/Ministry of Sustainable Development/St. Kitts and Nevis Bureau of Standards	2021 – 2030	Energy Demand	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To reduce power demand by 20% by implementing increased adoption of energy-efficient appliances and improved building energy-efficient measures.					
Brief description					
Fossil fuels currently dominate St. Kitts and Nevis's energy mix. The promotion of energy-efficient equipment will reduce the need for electricity from fossil fuel sources. In addition, SKN has adopted the Caricom Regional Energy Efficiency Building Code (CREEBC). The CREEBC is expected to improve buildings' designs by reducing energy demand and improving resilience. It is expected that the building code will help reduce energy demand, whereby GHG emissions will be reduced in both new and renovated commercial and residential buildings.					
Steps to achieve mitigation action					
1. Develop a comprehensive awareness and education plan to promote energy-efficient equipment and the Caricom Regional Energy Efficiency Building Code (CREEBC). 2. Develop a suite of incentives for energy-efficient equipment to encourage uptake. 3. Implement projects with the use of energy-efficient equipment on public buildings. 4. Continued development of the labelling programme for energy-efficient equipment. 5. Prepare documents to amend as necessary and legislate the CREEBC.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: 1. Reduced demand in the power sector. 2. Legislated building code for new and renovated buildings. The estimated GHG emission reduction related to the implementation (when implemented alone) is 34.22 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. It was assumed that the promotion of energy-efficient equipment and CREEBC will reduce energy demand by 20% nation-wide.					
Progress indicators					
# labelling standards introduced for energy-efficient equipment # new and renovated buildings implemented using CREEBC					

practitioners trained in implementing the CREEBC # education and awareness programmes conducted for energy-efficient equipment and CREEBC
International Market Mechanisms
None

Table 5.26: Mitigation Action 3: Streetlighting Retrofits

Name of the mitigation action					
Streetlighting retrofits					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Completed	Energy Unit, SKELEC and NEVLEC	2019-2022	Energy Demand	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To reduce energy consumption from streetlighting					
Brief description					
Retrofits of HPS streetlights to LEDs will help reduce energy consumption and GHG emissions. The retrofits were conducted for all streetlights in the twin-island federation of St. Kitts and Nevis. The Government of SKN previously replaced 1,150 streetlights with LEDs from a bi-lateral aid project. Funding was received from the Caribbean Development Bank to replace the remaining streetlights in the twin-island federation. A total of 7,496 lamps were replaced throughout the twin-island federation.					
Steps to achieve mitigation action:					
The mitigation has been completed as of April 2022.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: The estimated GHG emission reduction related to the implementation (when implemented alone) is 3.99 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. The average wattage of the bulbs was 165 W and replaced with 60 W LEDs.					
Progress indicators					
% reduction in energy consumption and energy demand # of HPS lights replaced with LED lights					
International Market Mechanisms					
None					

Table 5.27: Mitigation Action 4: Retrofit of floodlights at sporting facilities

Name of the mitigation action					
Retrofit of floodlights at sporting facilities					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Energy Unit, SKELEC and NEVLEC	2019-2023	Energy Demand	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To reduce energy consumption from lighting at sporting facilities					
Brief description					
Retrofits of HPS floodlights to LEDs will help reduce energy consumption and GHG emissions. The retrofits will be conducted for all floodlights at sporting facilities in the twin-island federation of St. Kitts and Nevis. The Government of SKN has secured funding from the Caribbean Development Bank to undertake the project.					
Steps to achieve mitigation action					
1. Complete retrofits of floodlights.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: The estimated GHG emission reduction related to the implementation (when implemented alone) is 1.07 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. The assumptions were as follows: The number of lights to be replaced was 1,021. The original wattage of the bulbs is 1000W, and they will be replaced with bulbs of 400 W.					
Progress indicators					
% reduction in energy demand # HPS lights replaced with LEDs					
International Market Mechanisms					
None					

Table 5.28: Mitigation Action 5: Implementation of measures identified in energy audits of public buildings and pumping stations

Name of the mitigation action					
Implementation of measures identified in energy audits of public buildings and pumping stations					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Planned	Energy Unit, SKELEC, NEVLEC, Ministry of the Environment/Ministry of Sustainable Development	2022-2025	Energy Demand	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To reduce energy consumption by implementing recommended measures from energy audits					
Brief description					
Energy audits help identify specific energy efficiency options for buildings. Audits were completed at 35 locations. 16 public buildings; 8 public buildings in St. Kitts, and 8 in Nevis, including one school. Audits were also completed at 19 pumping stations: 13 on St. Kitts and 6 on Nevis. The audits also included distributed generation systems to be implemented on the public buildings.					
Steps to achieve mitigation action					
1. Implement energy -efficient measures identified for each building. 2. Completion of tariff study consultancy to facilitate the installation of grid-tied PV systems. 3. Approve and adopt grid code regulations. 4. Procurement and installation of PV systems for the identified buildings from the energy audit. 5. Development of a monitoring system to track changes and reduction in consumption and emissions.					
Estimated outcomes and estimated emission reductions					
By 2025, the following outcomes will be achieved: Reduction in energy demand for audited buildings The estimated GHG emission reduction related to the implementation (when implemented alone) is 4.31 $ktCO_2$-eq for energy efficiency measures and 5.3 $ktCO_2$-eq for distributed generation when compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. The energy audits estimated that the total electricity savings from energy efficiency measures would result in the reduction of GHG emissions by 3,627,335 kWh/year and from PV systems would result in 4,464,296 kWh/year. These reductions are expected to be achieved by 2025.					
Progress indicators					
% reduction in energy demand kWh/year reduction in electricity demand					
International Market Mechanisms					

None

Table 5.29: Mitigation Action 6: Transition to 100% renewable energy

Name of the mitigation action					
Transition to 100% renewable energy					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Energy Unit, SKELEC and NEVLEC	2019-2035	Electricity Generation	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To achieve 100% renewable energy generation by 2035					
Brief description					
Fossil fuels currently dominate St. Kitts and Nevis's energy mix. The twin-island federation has set a goal to reach 100% renewable energy generation through the following renewable energy projects: 1. 35.7 MW utility-scale solar PV capacity with 44.2 MWh lithium-ion battery storage facility by 2025. 2. 10 MW geothermal power in Nevis by 2030. 3. 6.6 MW wind power in St. Kitts by 2030. 4. 15 MW geothermal power capacity in St. Kitts by 2035.					
Steps to achieve mitigation action					
To achieve this mitigation action, each renewable energy project has a list of activities to be performed. This will be included in the detailed table for each renewable energy project.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Increased renewable energy penetration in the electricity sub-sector. The estimated GHG emission reduction related to the implementation (when implemented alone) is 129.15 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. All renewable energy projects will be financed and implemented during the time frame indicated. It is assumed that some of the diesel generators will be retired.					
Progress indicators					
#kW of renewable energy technology installed #kWh of renewable energy generated					
International Market Mechanisms					
None					

Table 5.30: Mitigation Action 7: 35.7 MW of utility-scale solar PV capacity for St. Kitts with 44.2 MWh lithium battery storage

Name of the mitigation action					
35.7 MW of utility-scale solar PV capacity for St. Kitts with 44.2 MWh lithium battery storage					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Energy Unit and SKELEC	2021-2025	Electricity Generation	St. Kitts	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To increase the penetration of renewables through solar and reduce GHG emissions in the electricity generation subsector					
Brief description					
Fossil fuels currently dominate St. Kitts and Nevis' energy mix. Solar PV is one of the cheapest, most accessible renewable energy resources and the islands have an abundance of solar potential. The Government of St. Kitts and Nevis and SKELEC have signed a contract with a private developer for the installation of the 35.7 MW solar farm with storage on the island of St. Kitts. The overall system is expected to provide between 30-35% of St. Kitts' baseload energy needs for the next 20-25 years while reducing carbon dioxide emissions from year one of operation.					
Steps to achieve mitigation action					
1. Updated grid integration study for solar farms. 2. Installation of a solar farm with storage.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Increased renewable energy penetration from solar energy systems. The estimated GHG emission reduction related to the implementation is modelled as a group for 100% renewables.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. The assumption is that the current grid system can manage the increase of renewables without any upgrades. Storage was not modelled in this assessment.					
Progress indicators					
#kW solar installed #kWh solar energy generated from the system #kW of battery storage installed #kWh of energy stored					
International Market Mechanisms					
None					

Table 5.31: Mitigation Action 8: 6.6 MW of Wind Power capacity in St. Kitts

Name of the mitigation action					
6.6 MW of wind power capacity in St. Kitts					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Energy Unit, SKELEC	2021-2030	Electricity generation	St. Kitts	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To increase the penetration of renewables through wind on St. Kitts and reduce GHG emissions in the electricity generation subsector					
Brief description					
St. Kitts and Nevis' energy mix is currently dominated by fossil fuels. Transitioning to 100% renewable energy in power generation by 2030 can help the islands achieve their overall targets. St. Kitts and Nevis has the potential to further explore wind energy. Already, Nevis has installed a 1.9 MW wind farm. Wind power can provide renewable energy resources with the much-needed reactive power to the grid. The Government of SKN is currently in negotiations on wind development. A pre-feasibility study has been conducted under the "North Star Wind Farm" project, and a Power Purchase Agreement (PPA) is expected to be signed by 2023.					
Steps to achieve mitigation action					
1. Identification and acquisition of suitable land locations for installation. 2. Wind study at location for one year or specific site information. 3. Development of a suitable financial plan for the development of the wind farm; 4. Wind integration studies and impact assessment. 5. Procurement and installation of the wind farm.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Increased renewable energy penetration from wind power. The estimated GHG emission reduction related to the implementation is modelled as a group for 100% renewables.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. The assumption is that the current grid system can manage the increase of renewables without any upgrades.					
Progress indicators					
#kW of wind power capacity installed #kWh of wind power generated					
International Market Mechanisms					
None					

Table 5.32: Mitigation Action 9: 15 MW of geothermal power capacity in Saint Kitts

Name of the mitigation action					
15 MW of geothermal power capacity in St. Kitts					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Energy Unit, SKELEC	2019-2035	Electricity generation	St. Kitts	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To increase the penetration of renewables through geothermal on St. Kitts and reduce GHG emissions in the electricity generation subsector					
Brief description					
St. Kitts and Nevis' energy mix is currently dominated by fossil fuels. Transitioning to 100% renewable energy in power generation by 2030 can help the islands achieve their overall targets. The Government of St. Kitts and Nevis has identified a suitable site, and pre-feasibility studies have been conducted.					
Steps to achieve mitigation action					
1. Site assessment of the potential geothermal area. 2. Slim hole drilling and ESIA to verify the resource type in the Sandy Point area. 3. Once the resource is verified, deep well drilling for production and reinjection wells. 4. Engineering and construction of powerplant and transmission system. 5. In addition, further ESIA and grid integration studies are required. 6. Draft and approve legal documentation 7. Continued training, education, and awareness of geothermal.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Increased renewable energy penetration from geothermal energy systems. The estimated GHG emission reduction related to the implementation is modelled as a group for 100% renewables.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. Due to the level of preparation for the St. Kitts geothermal system, the expected completion date is 2035 and not 2030 as in the updated NDC.					
Progress indicators					
# of successful well drilled construction of power plants grid integration studies completed #kWh of geothermal energy generated					
International Market Mechanisms					
None					

Table 33: Mitigation Action 10: 10 MW in geothermal power in Nevis

Name of the mitigation action					
10 MW in geothermal power in Nevis					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Energy Unit, NEVLEC	2015-2030	Electricity generation	Nevis	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To increase the penetration of renewables through geothermal on Nevis and reduce GHG emissions in the electricity generation subsector					
Brief description					
St. Kitts and Nevis' energy mix is currently dominated by fossil fuels. Transitioning to 100% renewable energy in power generation by 2030 can help the islands achieve their overall targets. The Government of St. Kitts and Nevis has been involved in geothermal development on the island of Nevis for years. Feasibility studies and drilling have been undertaken, and recent development for power plant construction has begun with site clearing and others. In addition, Nevis has invested in at least three persons studying geothermal at a higher level in Iceland.					
Steps to achieve mitigation action					
1. Grid integration study for geothermal power. 2. Environmental and Social Impact Assessment (ESIA) for the powerplant. 3. Begin construction of powerplant and transmission system. 4. Draft and approve necessary legal documents.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Increase renewable energy penetration from geothermal energy systems. The estimated GHG emission reduction related to the implementation is modelled as a group for 100% renewables.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. The construction of a geothermal powerplant and operation of the system may take a few years. Therefore, the powerplants are assumed to be in operation by 2030 and not 2025 as assumed in the updated NDC.					
Progress indicators					
Construction of power plants Grid integration studies completed #kWh of geothermal energy generated					
International Market Mechanisms					
None					

Table 5.34: Mitigation Action 11: Improve efficiency in transmission and distribution of electricity

Name of the mitigation action					
Improve efficiency in transmission and distribution of electricity					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Planned	SKELEC and NEVLEC	2022-2030	Electricity generation	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To increase the energy efficiency of the transmission and distribution system by reducing losses on both islands.					
Brief description					
St. Kitts and Nevis' energy mix is currently dominated by fossil fuels. Improving efficiency in transmission and distribution lines will help reduce losses in both islands, thus aiding them in achieving their overall targets. In order to facilitate more sustainable sources of energy, St. Kitts and Nevis shall undertake this project to create a more resilient infrastructure network. The Government of St. Kitts and Nevis has indicated the improvement of the transmission grid on both islands in their NDC. In addition, in the IRP, there is mention of the interconnection of the two island systems. Currently, an Integrated Resource and Resilience Plan (IRRP) for SKN is being developed.					
Steps to achieve mitigation action					
1. Identification of the necessary upgrades to the transmission and distribution systems to improve efficiency on both islands through studies and assessments. 2. Source funding and acquire and install the necessary equipment to upgrade the system.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Improved energy efficiency in the transmission and distribution systems. The estimated GHG emission reduction related to the implementation (when implemented alone) is 20.24 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. It was assumed that the current technical losses for transmission and distribution are 8.5% for Nevis and 12.5% for St. Kitts; an average was assumed at 11.3%. The total losses are assumed to reduce to 5% by 2030.					
Progress indicators					
% reduction in transmission and distribution losses					
International Market Mechanisms					
None					

Table 5.35: Mitigation Action 12: Electricity interconnection system for the two islands

Name of the mitigation action					
Electricity interconnection system for the two islands					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Newly Proposed	Energy Unit, SKELEC and NEVLEC	2022-2030	Electricity Generation	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To enable the interchange of electricity between the two islands					
Brief description					
St. Kitts and Nevis is a twin island nation separated by waters, and the shortest distance between the two is 3.29 km. Therefore, the short distance allows for underground cables to connect the islands enabling sharing of resources and maximising renewable energy potential where it is most available. Furthermore, the IRP produced for St. Kitts and Nevis indicated that the interconnection of the two islands would result in lower fuel costs and consumption, which would allow for the geothermal production to be increased on the island of Nevis and allow for transmission to St. Kitts and vice versa for solar energy. This would also increase the reliability of the two systems.					
Steps to achieve mitigation action					
1. Feasibility studies for technical viability and cost, including a cost-benefit analysis. 2. Financial resources obtained, and environmental and social impact assessment conducted. 3. Tender and sources of technical expertise to complete the project. 4. Implementation of the project.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Increased grid reliability, reduced fuel consumption in the power sector and increased penetration of renewables.					
Methodologies and assumptions					
This action was not explicitly modelled in LEAP. However, the two systems were modelled together, and therefore an interconnection of the system can be assumed.					
Progress indicators					
Feasibility studies completed Interconnect power system constructed					
International Market Mechanisms					
None					

Table 5.36: Mitigation Action 13: Development of Electric Vehicles Charging infrastructure by 2030

Name of the mitigation action					
Development of electric vehicles charging infrastructure by 2030					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Planned	Energy Unit, SKELEC and NEVLEC,	2022-2030	Transport	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To facilitate the increased penetration of electric vehicles					
Brief description					
The development of EV infrastructure can aid the overall transition to use more EVs in the vehicle fleet. The Government of St. Kitts and Nevis has indicated its plans for the development of electric charging stations on the islands. Currently, no charging stations are installed.					
Steps to achieve mitigation action:					
1. Identify suitable location and type of chargers required for installation. 2. Grid Integration studies for charging facilities. 3. Develop an EV charging station infrastructure plan. 4. Develop terms of reference for service providers and the use of charging stations. 5. Procure and install charging stations.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Increased penetration of electric vehicles.					
Methodologies and assumptions					
This action is considered an enabling condition for the increased penetration of electric vehicles and therefore, not modelled.					
Progress indicators					
# charging station installed					
International Market Mechanisms					
None					

Table 5.37: Mitigation Action 14: 2% of the total number of vehicles are electric vehicles, and 2% of the total number will be hybrid by 2030

Name of the mitigation action					
2% of the total number of vehicles are electric vehicles, and 2% of the total number will be hybrid by 2030					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Planned	Energy Unit, Ministry of the Environment, Department of Transport, Inland Revenue Department	2022-2030	Transport	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To increase penetration of electric vehicles and reduce consumption of fossil fuel in the transport sector					
Brief description					
Electrification of 2% of vehicles allows for a more climate-friendly method of transport to be used, thus reducing overall emissions from this sector. The Government of St. Kitts and Nevis and the Caribbean Community Climate Change Centre (CCCCC), with financial support from the Government of Italy, initiated a project to install two solar-powered battery charging stations and purchase three electric vehicles. The project encountered some difficulty, but the Government is seeking efforts to re-commence this project.					
Steps to achieve mitigation action					
1. Installation of charging infrastructure. 2. Increase public education and awareness of electric vehicles. 3. Encourage sale by retailers. 4. Implementation of incentives to encourage uptake. 5. Training of mechanics and first responders to operate, maintain and handle electric vehicles. 6. Implementation of specific projects to increase electric vehicles uptake in the public sector. 7. Introduction of financing mechanisms for the acquisition of electric vehicles in the private sector.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Reduction in emissions in the transport sector through the increased use of electric vehicles. When implemented alone (e.g., without higher penetration of renewables in the power sector), this measure increases emissions of +0.03 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. In the mitigation scenario, electric and hybrid vehicles will account for 2% of the total fleet, respectively and 10% by 2050. A more ambitious scenario assumes a 12% each for electric vehicles and hybrid vehicles with an increase of 40% by 2050.					
Progress indicators					

# of electric vehicles introduced into the country
International Market Mechanisms
None

Table 5.38: Mitigation Action 15: Public transportation expansion and improvement for a shift of 20% from personal cars and SUVs after 2025

Name of the mitigation action					
Public transportation expansion and improvement for a shift of 20% from personal cars and SUVs after 2025					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Planned	Energy Unit, Ministry of the Environment, Department of Transport, Inland Revenue Department	2022-2025	Transport	National	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O)
Objective of the mitigation action					
To increase the use of public transport; to increase energy efficiency in the transport sector; to help reduce commute time by reducing the number of private vehicles on the road.					
Brief description					
Increased access to public transport and increased reliability may help reduce the use of private vehicles, causing a modal shift and thereby reducing the fossil fuel consumption in the transport sector and assisting in traffic management. Managing travel demand for different areas and increasing planning in the public transport system should be considered.					
Steps to achieve mitigation action					
1. Development of a comprehensive public transport strategy to expand routes. 2. Incentives to encourage public transport drivers to expand routes. 3. Public education and awareness to encourage the use of public transport.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Reduction in emissions in the transport sector through the increased use of public transport reduces commute times. When implemented alone, (e.g., without higher penetration of renewables in the power sector), this measure results in an increase in emissions of 1.67 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. The assumption assumes that 20% of the sales of personal cars and SUVs will be reduced, and that shift will be towards the increased use of public transportation trend. A more ambitious scenario considers a reduction of 30% in sales of SUVs and cars and increases in the public transport system.					
Progress indicators					
# new areas with public transport access					

minutes of reduced commute times # reduced private vehicles on the road during peak hours
International Market Mechanisms
None

Table 5.39: Mitigation Action 16: 10% Phase-down of HFC

Name of the mitigation action					
10% Phase-down of HFC					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Planned	Ozone Unit, Ministry of the Environment, Customs Department	2023-2030	IPPU	National	HFCs
Objective of the mitigation action					
To reduce the use of HFC refrigerants					
Brief description					
Encouraging alternatives to HFC refrigerants through ratification of the Kigali amendment and improving the sector's energy efficiency. The ozone unit is currently in the initial phases of assessment for HFCs in the country. St. Kitts and Nevis has been implementing the Montreal Protocol, and efforts are being made to ratify the Kigali amendment.					
Steps to achieve mitigation action:					
1. Facilitation and support of the ratification of the Kigali Amendment. 2. Establishment of an overall national policy framework to address the hydrofluorocarbon (HFCs) phase-down process. 3. Creation of coordination mechanisms to highlight gaps and determine capacity needs to support the Kigali Amendment implementation. 4. Technical assistance for safe adoption of alternative HFC technologies with the local market. 5. Revisions to the current licensing and data reporting systems to include HFCs. 6. Baseline data and information compiled on the existing HFC products and information on alternative options available to support the phase-down plan. 7. Education and awareness throughout the public and private sectors on the ratification and implementation of the Kigali Amendment.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Reduced GHG emissions and increased energy efficiency in the sector, with focus on the refrigeration and air conditioning (RAC).					
Methodologies and assumptions					
Due to the unavailability of baseline data, this action was not modelled in LEAP. However, it is anticipated that this action will be modelled in future reporting cycles.					

Progress indicators
% reduction in the importation of HFCs
International Market Mechanisms
None

Table 5.40: Mitigation Action 17: Reduction of landfill waste by 2% through recycling and composting systems

Name of the mitigation action					
Reduction of landfill waste by 2% through recycling and composting systems					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	St. Kitts Solid Waste Management Corporation, Nevis Solid Waste Management Authority, Ministry of the Environment	2022 - 2030	Waste	National	Methane (CH_4),
Objective of the mitigation action					
To encourage practices that will result in reducing waste to the landfill					
Brief description					
The reduction of landfill waste can be implemented through various methods. 1. St. Kitts and Nevis are currently implementing a pilot recycling project to reduce plastic and other waste entering the landfill. 2. Composting system also helps reduce organic waste from entering the landfill. The Government of St. Kitts and Nevis has initiated a recycling pilot project with support from the Government of Taiwan in China. This project is in its preparation phase. The composting component is newly proposed and no details on implementation have been completed.					
Steps to achieve mitigation action					
1. Implement a pilot recycling project and collection of relevant data. 2. Public awareness and education campaigns for recycling and home composting methods. 3. Data collection on the impact of awareness campaigns on waste in the landfill					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Reduced waste to the landfill and reduced GHG emissions. The estimated GHG emission reduction related to the implementation is 0.98 $ktCO_2$-eq compared to the baseline.					
Methodologies and assumptions					

This action was modelled in the Low Emissions Analysis Platform (LEAP) software. It is assumed that a 2% reduction by 2030 in solid waste disposal emissions will be achieved through recycling and composting systems.
Progress indicators
% reduction of waste to the landfill
International Market Mechanisms
None

Table 5.41: Mitigation Action 18: Increase of 3% of carbon sinks through reforestation and related practices

Name of the mitigation action					
Increase of 3% of carbon sinks through reforestation and related practices					
Status	Lead Agency/Agencies	Duration	Sector and subsector	Scope	GHGs covered
Ongoing	Forestry unit Ministry of the Environment	2022-2030	Agriculture, LULUCF	National	Carbon Dioxide (CO_2),
Objective of the mitigation action					
To increase emission sinks and enhance sustainable management					
Brief description					
The GEF-6 Project "Improving Environmental Management through Sustainable Land Management in St. Kitts and Nevis" project aims to achieve sustainable land and natural resources of over 500ha. The Government of St. Kitts and Nevis has launched the GEF-6 project which includes plans for 500ha of sustainable land management through agroforestry practices, reforestation, mangrove rehabilitation, and assisted natural regeneration.					
Steps to achieve mitigation action					
1. Identify suitable locations for each component of the GEF-6 project. 2. Implementation of the project.					
Estimated outcomes and estimated emission reductions					
By 2030, the following outcomes will be achieved: Increased sequestration potential for emissions. The estimated GHG emission reduction related to the implementation is 3.40 $ktCO_2$ compared to the baseline.					
Methodologies and assumptions					
This action was modelled in the Low Emissions Analysis Platform (LEAP) software. A 3% increase by 2030 in carbon sinks through reforestation and related practices is expected.					
Progress indicators					
#ha of agroforestry practices #ha of sustainable land management practices					
International Market Mechanisms					

None

5.10 INTERNATIONAL MARKET MECHANISMS

St. Kitts and Nevis is a non-Annex 1 Party and is eligible to participate in the Clean Development Mechanism (CDM). The CDM under the Kyoto Protocol allows a developed/industrialised country with an emission-reduction or emission-limitation commitment to implement an emission reduction project in a developing country. However, SKN currently has no projects registered with the CDM or other international markets.

The recently concluded negotiations on Article 6 of the Paris Agreement highlight the need to encourage small and micro businesses in the mechanism, particularly in the least developed countries and small island developing states. Accordingly, SKN has indicated an interest in exploring suitable, beneficial projects in the international markets in both submissions of their NDCs.

5.11 BARRIERS AND CHALLENGES

A summary of the main barriers and challenges in conducting the mitigation assessment and the implementation of the mitigation actions are highlighted below.

Barriers and Challenges

- Lack of Adequate Data - Data quality and availability were identified as the main challenges throughout the development of the model. Insufficient data will result in limited accuracy in the modelling and create major challenges for monitoring, verification, and reporting.
    - F-Gases - St. Kitts and Nevis currently has a licencing system for HCFCs that tracks and reports the importation of these f-gases. However, no such system exists for HFCs consequently data on these gases is unavailable. It is expected that through the ratification of the Kigali Amendment of the Montreal Protocol, a similar licensing system for HFCs will be operationalised. This will provide much disaggregated data from the national ozone unit and though online data repository of the ozone secretariat.
- High Capital Costs – Renewable energy initiatives normally require high capital costs. Although St. Kitts and Nevis is considered a high-income country, the unique challenges of SIDS need to be taken into consideration. Therefore, it is essential that access to climate

finance grants and low-interest loans be made available to SIDS to help reduce the costs of implementation.

- Technology Suitability/Availability – St. Kitts and Nevis has identified geothermal development on the island of St. Kitts and the island of Nevis. The development of this technology is in its advanced stage in Nevis but in its infancy in St. Kitts. Therefore, it is important that St. Kitts verify the availability of the resource. Furthermore, it is essential that capacity building in suitable technologies be conducted for the sustainability of implementation.
- Natural Disasters – St. Kitts and Nevis lies within the tropical belt and is the direct path of hurricanes, with the latest being Hurricanes Irma and Maria (2017). It is expected that extreme weather events will become more frequent and intensify with increased global warming and climate change. This creates major challenges for the sequestration potential of the LULUCF sector.
- Land Availability – St. Kitts and Nevis has limited surface area. Therefore, there is a need to balance the enhancement and protection of the LULUCF sector as well as increase the renewable energy penetration. Land-use zoning will be of critical importance.

5.11.1 Key Needs for Improving Modelling

- Improvement in data collection, having more disaggregated data on the building sector in Nevis and the level of use of appliances SKN would allow for more detailed modelling. This would create a more transparent assessment of mitigation actions.
- The LEAP model can be a useful tool for monitoring the implementation of projects. Therefore, further examination of the model needs to be conducted, and adequately skilled persons identified to monitor the implementations of projects and to update the LEAP model.
- Continued development of a mitigation team to continuously update the mitigation assessment.

Chapter 6 FTC- Needs and Support Received

6.1. Constraints, gaps, and prioritised needs

St. Kitts and Nevis, in its previous submissions to the UNFCCC (NC1, NC2, and NDC) has identified data gaps, institutional barriers and transparency issues that have impeded its attempts to adhere to the transparency, accuracy, completeness, comparability and consistency (TACCC) principles (guiding principles for preparing and reporting inventories) during previous reporting cycles.

The newly enhanced reporting requirements under the Enhanced Transparency Framework (ETF) and its associated modalities, procedures, and guidelines (MPGs) along with the need to improve the overall national reporting cycle (inventory, NDC, adaptation and support) has guided St. Kitts and Nevis to identify the following during the BUR1 reporting process:

- Constraints and gaps in GHG inventory, mitigation, adaptation, and climate finance reporting.
- Prioritised needs and improvements to facilitate improved reporting for future cycles in adherence with the TACCC principles.

The following tables, (**Error! Reference source not found.** and **Error! Reference source not found.**) summarise the observed constraints and gaps identified by the relevant compilation teams. These are further validated by in-country stakeholders and identified as prioritised needs.

Table 6.42 Constraints and gaps by reporting type

GHG Inventory - Constraints and Gaps Observed during TNC/BUR1 Process	
Lack of adequate data	Availability of data with the requisite quality from national sources and stakeholders for key emitting sectors was the main challenge for estimating emissions and removals for this inventory cycle. Data issues by sector are identified in the areas of improvement Table 2.10 in the GHGI chapter.
Limited coordination for GHG inventory cycle	As with most countries in the Caribbean region, St. Kitts and Nevis has been heavily reliant on international consultants for its previous inventory cycles. For the TNC/BUR1, the project team selected a blend of local, regional, and international consultants. Though institutional arrangements and legal arrangements for coordinating timely GHG inventory reports was noted as a limiting factor in this reporting cycle. It should be noted that efforts have been made to identify the roles/responsibilities of the envisaged coordinating entity, data providers and sector experts,

	with the aim of institutionalising the process for the next reporting cycle.
Capacity constraints in applying GHG inventory methodologies	Familiarity with the IPCC guidelines and lack of sectoral technical capacity was noted as a major constraint and affected the overall flow of information with regards to data collection, quality control checks and choice of methodology. Initial capacity building activities were embedded within the project with identified data providers and GHGI compilers participating in multiple workshops.
Limited understanding of all GHG emitting activities in the country (completeness)	A clear understanding of all emitting categories was difficult to determine during the data collection process leading to some categories not being estimated. Example, 2F Product Uses as substitutes for ozone depleting substances and 3C2 Liming. As capacity increases in understanding all emitting categories to be reported as well as the required activity data and input parameters needed for GHGI calculations, completeness of reporting is expected to improve.
Lack of archiving from previous reporting cycles	Most data, methods, and calculations from the two previous GHG inventories were not successfully documented and archived. Excel sheets provided from the previous inventory cycle was minimal with accompanying activity data and background information not provided. New efforts were required to source historical data for the timeseries to allow for revision/recalculation of previous estimates.
Mitigation - Constraints and Gaps Observed during TNC/BUR1 Process	
Lack of adequate data	Availability of quality data was identified as one of the main challenges throughout the development of the model. The following were identified as the main constraints/gaps with regards to data: • Population growth projections by island • Long-term GDP forecasts by island and by major sectors • No building use data for fuels and electricity • Lack of data on HFCs imported

	• No comprehensive data on vehicle fuel efficiency • Adequate costing information for mitigation actions not available • Inadequate data to allow cost analysis for mitigation measures • Data limitations in energy and end-use sectors • Comprehensive data on energy end-use such as lighting, water heating, air conditioning was not available, and many assumptions were made in the analysis
Limited technical and human capacity of stakeholders	The mitigation sector was identified as a major challenge. The following was noted: • Limited human resource capacity to adequately undertake and understand mitigation assessments • Need of education on the technology installation completion timeframes
Intra-ministerial coordination and communication	Although the mitigation actions in the NDC are clearly identified under separate sectors, the governance and responsibility for some of these actions were not always clearly defined across ministries and departments. It is important to empower coordination through an established National Climate Change Committee for St. Kitts and Nevis. This committee should consist of relevant persons from identified ministries to address and minimise this challenge.
High Capital Costs	Renewable Energy Initiatives normally require high capital costs. Although St. Kitts and Nevis is considered a high-income country, the unique challenges of SIDS need to be taken into consideration. Therefore, it is essential that access to climate finance grants and low-interest loans be made available to SIDS to help reduce the costs of implementation.
Technology Suitability/Availability	St. Kitts and Nevis has identified geothermal development on the island of St. Kitts and the island of Nevis. The development of this technology is in its

	advanced stage in Nevis but in its infancy in St. Kitts. Therefore, it is essential that St. Kitts verify the availability of the resource as well as to ensure that capacity building activities are suitable and sustainable.
Data transparency issues	Lack of development and implementation of legislation and agreements to facilitate data collection and sharing among institutions.
Energy Balances by island and subsector	Though the energy balances developed by the CCMRVH team during the TNC/BUR1 project and previous estimates from OLADE (2010-2012) assisted with mitigation analysis, there is no system to continuously update these energy balances. Additionally, balances were not disaggregated by island.
Land Availability	St. Kitts and Nevis has limited surface area. Therefore, there is a need to balance the enhancement and protection of the LULUCF sector as well as increase the renewable energy penetration. Land-use zoning will be of critical importance.
Political Will	Implementing mitigation actions requires broad political support and effective planning to maximise opportunities. Therefore, it is essential that sensitisation and education of high-level decision-makers to the climate change needs are sustained.
Adaptation - Constraints and Gaps Observed during TNC/BUR1 Process	
Mandates and Agendas	No specific policy or legislative provisions with relevant sustainable development goals (SDG) inclusive of SDG 13 on climate action. SDG 13 goals include: • Integration of climate change measures into national policies, strategies, and planning • Education and awareness raising on climate change mitigation, adaptation, impact reduction and early warning

	• Human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning • Strengthening of resilience and adaptative capacity to climate related hazards and natural disasters
Legislation	No unifying legislation specifically regulating climate action but does have several legislative mechanisms that can be effectively used for this purpose (see section 4.1.2- legislation-adaptation chapter). Gaps include stronger dedicated mechanisms for mandating actions to address climate change such as: • Integrated water resources management (IWRM) • Integrated coastal zone management (ICZM) • Extractive industries (mines and quarries) and forestry • Environmental and public health
Institutional and Human Resource Capacity	• Lack of sector specific action planning using National Adaptation Strategy as guidance • Understanding and/or lack of staff to serve as dedicated CCA focal points • Lack of resources to generate data to support decision making and planning
Information, Technology and Data Systems	• Lack of Nevis data needed to characterise adaptive capacity • Lack of data sharing mechanism amongst sectors (Example, health, water, and tourism) • No early warning system for the health sector
Funding	Lack of funding to implement recommendations of the St. Kitts and Nevis National Climate Change Adaptation Strategy.
MRV Assessment - Constraints and Gaps Observed during TNC/BUR1 Process	
Intra-organisational coordination and communication	Lack of coordination across ministries, local government, private sector, and other stakeholders

	who participate in climate change actions across all sectors.
Need for greater public awareness	Climate change initiatives through planned education and awareness campaigns from primary education to broader public awareness campaigns to increase general public buy-in.
Limited staff at envisaged Coordinating Entity	Particularly full-time staff to keep up with the demands of new national commitments for enhancing national climate MRV systems, and other related permanent functions such as participation in National GHGI preparation, tracking of implementation and progress of NDC goals, adaptation actions and climate support tracking.
Limited sectoral technical capacity (data collection and calculations)	Due to limited institutionalised technical capacity, some entities/stakeholders responsible for data collection are also responsible as the sectoral expert for compilation of the GHGI. Balancing previous responsibilities in addition to these new action tasks was identified as a limitation to the sustainability of the proposed national MRV system.
Lack of adequate funding	To implement climate goals and monitor execution in the medium to long term.
Limited legislation or compliance mechanisms	To mandate the execution and continuity of climate related activities that are internationally binding (reporting under the Paris Agreement, Montreal Protocol, etc.) inclusive of mandatory data collection/reporting by stakeholders.
Stakeholder hesitation	In providing information whilst mapping data flows and communication channels across climate reporting pillars (mitigation and adaptation) was a limiting factor in the drafting of new institutional arrangements for the proposed St. Kitts and Nevis National MRV System.

Difficulty in collecting data and reporting	Across all sectors, as data is not currently collected for the purpose of climate change reporting. During the TNC/BUR1 process, initial sensitisation of necessary datasets was conducted with data collectors and stakeholders involved in the process.

Table 6.43 Identified prioritised needs by reporting type

GHG Inventory - Prioritised Needs Identified during TNC/BUR1 reporting process	
Institutional Arrangements and GHG Inventory Cycle	• Set up appropriate institutional, procedural, legal arrangements, and documentation for recurring preparation of the national GHG inventory. • Appoint a national GHG inventory compilation team. • Fully establish and implement QA/QC procedures for the national GHG inventory. • Fully establish data collection and archiving procedures for the national GHG inventory.
Energy Sector	• Extract air control data for a specific year to get the number of domestic flights and aircraft types between SKB-NEV (arrivals and departures). • Collect data on passengers on domestic route (SKB-NEV) from departure fees from St. Kitts Sea and Port Authority • Collect activity data related to domestic navigation.
IPPU Sector	Estimation of the amount of stationary air conditioning in place in households using the bottom-up approach by conducting surveys. Direct questionnaires should be used for bigger commercial facilities and the hospitality sector. Approach should be calibrated using top-down information on the import of F-gases and AC appliances.

Agriculture Sector	Data from FAOSTAT was used during the TNC/BUR1 inventory cycle as country specific information was unavailable. • Investigate differences between FAOSTAT dataset and those initial datasets collected by in-country team. • Collect livestock estimates for Nevis to be integrated with estimates from St. Kitts.
FOLU Sector	• Conduct field surveys and measurements in the FOLU sector to develop country specific emission factors to help improve accuracy of GHG emissions. • Generate emission factors for forest, grasslands, and wetlands with woody vegetation as a priority. • Conduct training of Forestry staff who have ground knowledge of the country as well as some GIS expertise to embed capacity in the St. Kitts and Nevis team for future reporting requirements.
Waste Sector	• Conduct survey and/or study on the degree of utilisation of the identified wastewater treatment systems by IPCC urbanisation characteristics. • Validate previous waste tonnage estimates at solid waste disposal sites and compare against current IPCC (2006 and 2019 refinement) default values used of waste per capita. • Collect information on the wastewater treatment system used by brewery to update estimates of the relevant emission factors using Bo and MCF.
Mitigation - Prioritised Needs identified during TNC/BUR1 reporting process	
Data Collection	• More disaggregation of the building sector in Nevis and the level of use of appliances St. Kitts and Nevis would allow for more detailed modelling. This would create a more transparent assessment of mitigation actions. • Improvement in the data collection for the HFCs in the IPPU sector through the ratification

	of the Kigali Amendment of the Montreal Protocol and introduction on licensing systems for HFCs and natural refrigerants. • Improvement in the macroeconomic data per island. Although both St. Kitts and Nevis have distinguished data in most areas, their economic data is not disaggregated and therefore it is difficult to model as separate islands. • Improvement in the collection of transport data. Further disaggregation of data for the transport sector will allow for a more comprehensive model of the aforementioned subsector. • Develop and track identified performance indicators to monitor the progress and implementation of mitigation actions.
Modelling Prioritised needs	• The LEAP model can be a useful tool for monitoring the implementation of projects. Therefore, further examination of the model needs to be conducted. • Once the necessary data is acquired, modelling of the two islands can occur separately with the inclusion of a scenario with interconnection. • More comprehensive modelling for the transport subsector, once data can be obtained. • Bottom-up modelling for the energy demand subsector is required to improve the ease of updating the modelling.
Capacity Building	• Continued development of a mitigation team to continuously update the mitigation assessment. • Adequately skilled persons identified to monitor the implementation projects and update the LEAP model. • Continued development of persons skilled in IPCC guidelines and inventory. • Development of data collection team for mitigation assessment.

	• Assessment of data transparency issues and development of agreements to facilitate data sharing among institutions, for example, by anonymising data (e.g., sharing semi-aggregate information by power plant type instead of by individual facilities so that interests of private companies are protected while also contributing to the public knowledge).
Adaptation - Prioritised Needs identified during TNC/BUR1 reporting process	
As highlighted in the adaptation chapter of the TNC, the consultant team prepared a list of prioritised improvements for consideration by the St. Kitts and Nevis project team as well as all identified stakeholders involved in the sector. Through a workshop, participants were asked to prioritise identified actions by applying Multi-Criteria Analysis (MCA) to evaluate the merits of the recommended adaptation options. Based on the scoring rubric, identified actions rated 4 out of 5 or higher have been included as prioritised needs below:	
Planning and Infrastructure	• Improvements to knowledge base and capacity to support evidence-based planning and implementation. At a minimum there is a need for GIS-based modelling to determine coastal areas most at risk to inundation given current elevations and projected SLR rates at a high resolution. • Audit of public infrastructure to determine integrity given higher and more prevalent temperature conditions.
Human Health	• Implementation of a public awareness programme aimed at measures to encourage storage of rainwater to prevent incubation of vectors. • Encouragement of those with household gardens to augment food supply and use rainwater harvesting technique to augment water supply (resilience to water and food insecurity). • Consideration of ecosystem-based adaptation (EbA) adaptation to heat impacts for larger urban areas like Basseterre, Fig Tree, Market

	Shop, Saint Paul's, and Middle Island. These should include consideration of urban forests, increased green spaces and green roofs.
Agriculture	• Creation of a model greenhouse to demonstrate hurricane resilience using sustainable energy and waste recycling technologies options built in. Incentives for adoption by small-farmers and entrepreneurs can include availability of design templates, possible incubator agricultural sub-divisions (with centralised water, clean energy, and waste management) as well as access to capital. Higher yielding food crops can be grown in greenhouses. • Research and development is needed to support diversification away from traditionally grown but at-risk crops. A food security strategy should take into account domestic consumer needs (including the restaurant and tourism sectors, as well as green markets etc) and the needs for export-oriented producers (e.g., sweet potatoes, peppers, peanuts, sea island cotton and coconuts etc). This should also include consideration of small-scale fisheries' current and potential contribution to food security.
Water Resources	Public awareness campaign for increased water conservation based on the predicted climate risk to the freshwater supplies is needed – possibly targeting tourism, health, agriculture, and urban areas. This can also be accompanied by integrating conservation technologies for water into building codes.
Coastal and Marine ecosystem	• The GIS modelling will also generate information on the development of new shallow marine areas that can be evaluated for creation of mangroves and other coastal ecosystems that offer some level of coastal protection or other ecosystem services like fish nurseries. Additionally, some of these areas

	may be feasible locations for small-scale sustainable mariculture development. • Seasonal and post-storm (recovery) monitoring of priority beaches: recreational, fish landing, and turtle-nesting. • Careful evaluation of the likely impacts of sea level rise on the coastal salt ponds and assessment of whether these can be used for sectoral adaptation purposes.
Community-Based Adaptation	• Need to catalyse development of community-based organisations (CBOs) in St Kitts and Nevis. This may build on work done by NEMA in communities, social welfare or other NGOs or youth groups. Grass-roots CBOs can promote awareness and implementation of key climate actions that result in growing resilience and adaptive capacity of communities. This can be in connection with co-management or stewardship initiatives involving EbA to reduce non-climate stressors, as well as water and energy conservation. • More research is needed to determine how the measures currently or historically used by communities in St. Kitts and Nevis aided in recovery from extreme natural hazards, and whether this can be adapted to the expected new climate "normal". • Development of alternative livelihoods (and training) and cooperatives to increase adaptive capacity for climate-impacted occupations and sectors such as rain-fed small-farming. These measures should consider the vulnerability and needs of female-headed low-income households. • The use of early warning systems, digital technologies and citizen science may be challenging where communities and households lack access to mobile phones or internet. However, it is likely that most individuals do have access to the aforementioned. To offset the challenges in rural communities or low-income households,

	priority should be placed on ensuring that there are public access points (like schools, libraries and internet cafes) for community members to access early warning systems and other climate-related information services. This aids in more adequate preparation and recovery from weather-related impacts and predicted longer term climate change effects or variability.
Improving Readiness	• Address legislative gaps and statutory reform needs for climate change integration into IWRM, ICZM, Mining & Forestry and Public Health. • Explore opportunities for leveraging synergies with other international agendas such as the UN SDGs and the Blue Economy, which is supported by the Caribbean Development Bank, World Bank and the IADB.
MRV Assessment - Prioritised Needs identified during TNC/BUR1 reporting process	
MRV System Planning, Preparation, and Implementation	• Ensure that all relevant government agencies, private stakeholders, and data collectors are involved in the inventory process. • Initiate appropriate legislation to facilitate access to data and data collection. In the interim, efforts should be made to implement Memorandums of Understanding to facilitate data sharing between stakeholders and the GHGI compilation team. • Contact the main industries in the country and open a communication channel for data collection/exchange, considering the confidentiality option. • Establish a process to ensure a common understanding of data needs and a consensus on data to use. • Organise meetings and open communication channels between all stakeholders to ensure a common understanding of the data requirements throughout the inventory process.

	• Set up a national inventory management system, that includes the procedural arrangements to produce the inventory in a timely manner. • Set up a National GHG Inventory Management System, that includes legal arrangements for inventory planning, preparation, and management. • Establish and implement a sustainable MRV system with appropriate institutional, procedural, and legal arrangements with clear reporting and documentation requirements. • Ensure appropriate administrative capacity within MRV system and with focus on the Department of Customs as one of the main data source providers. • Embed quality control procedures throughout the MRV system and enact a set of QA procedures to assess the accuracy of final GHG inventory estimates. • Establishment of National Climate Change Committee for St. Kitts and Nevis.

6.2 Progress towards addressing constraints and gaps

St. Kitts and Nevis has made progress towards addressing constraints and gaps since submission of its second national communication (SNC). Table 6.44 highlights the identified improvements observed during the 3rd national communication (TNC)/BUR1 cycle as it relates to MRV systems, GHG inventory, mitigation, and adaptation.

Table 6.44 Progress made from SNC to TNC

Gaps identified in SNC	Progress identified during TNC/BUR1
Availability and Suitability of Technology	Conducting country driven Technology Needs Assessment (TNA) in prioritised sectors. At the time of writing, a prioritised list of technologies for adaptation has been identified. The mitigation actions and activities as part of the TNA process has not yet been identified.

Data gaps - Energy Sector (prioritisation of the transport sector	Identified and engaged key stakeholders in the transportation sector and identified main data sources for improvement.
Data Gaps - Waste Sector	Identified and engaged key stakeholders in the solid waste and wastewater sub-categories and identified main data sources for improvement.
GHG emission estimates- Waste Sector	GHG emission estimates for the waste sector were not estimated in the SNC. The TNC includes estimates for both the current timeseries (2008 onwards) as well as the timeseries covered during the SNC. Tier 1 methodology used for estimates.
Data Gaps - FOLU sector	Identified and engaged key stakeholders in the FOLU sector and conducted GIS training to improve data sources and estimate emissions for the TNC.
Establishing a measurement, reporting and verification (MRV) mitigation system for St. Kitts and Nevis	Conducted an MRV Assessment during the TNC/BUR1 reporting cycle and indicated prioritised actions to implement an integrated National MRV System comprising all reporting sectors.
Updating of the information relevant for the reporting of Mitigation actions	Updated mitigation assessment conducted during the TNC cycle inclusive of the use of the LEAP model. Outputs used to guide the St. Kitts and Nevis revised NDC submission as well as identification of potential feasible mitigation actions.
Updating the information relevant for the reporting of Adaptation actions	National Adaptation Strategy drafted with implementation process beginning in 2018. Improved attention to partnerships and institutional coordination by: • Increased capacity building and engagement • Improved information management, research, and monitoring and evaluation • Explicitly considering climate resilience in disaster risk reduction (DRR) and investment and economic planning • Improved intersectoral coordination

Provision of training to build or improve the capacities of the relevant stakeholders to complete all required sections for UNFCCC reporting, taking into consideration the new reporting requirements of the Paris Agreement	Capacity building activities undertaken by local stakeholders in the fields of GHG inventory, Mitigation assessments and LEAP modelling and MRV. Stakeholders were trained not just in the technical elements of the reporting requirements but procedural elements as well to increase institutionalised memory of local stakeholders/experts.

6.3 Technology Needs

The Technology Needs Assessment (TNA) is a country-driven process that allows Parties to determine their climate technology priorities, and supports national sustainable development through a portfolio of environmentally sustainable technology (EST) projects and programmes, whilst building national capacity and tracking their needs for new technologies, skills, and equipment to reduce the vulnerability of sectors and livelihoods attributed to climate change as well as to reduce GHG emissions.

The Global TNA project is funded by the Global Environmental Facility (GEF) and implemented by UNEP in collaboration with UNEP DTU Partnership. In October 2020, the 4th phase of the Global TNA project was initiated including the small island developing state of St. Kitts and Nevis. National mitigation and adaptation consultants were hired in March 2021 with only information on the adaptation sector available at the time of writing. Technology needs associated with the mitigation sector were identified through action tasks on mitigation policies and assessment conducted during the TNC process. Timeline for the TNA for the adaptation sector is highlighted in Figure 1 below, with Figure 2 highlighting the institutional arrangements for the St. Kitts and Nevis TNA adaptation team.

Figure 6.1- Timeline of Technology Needs Assessment (TNA) Project

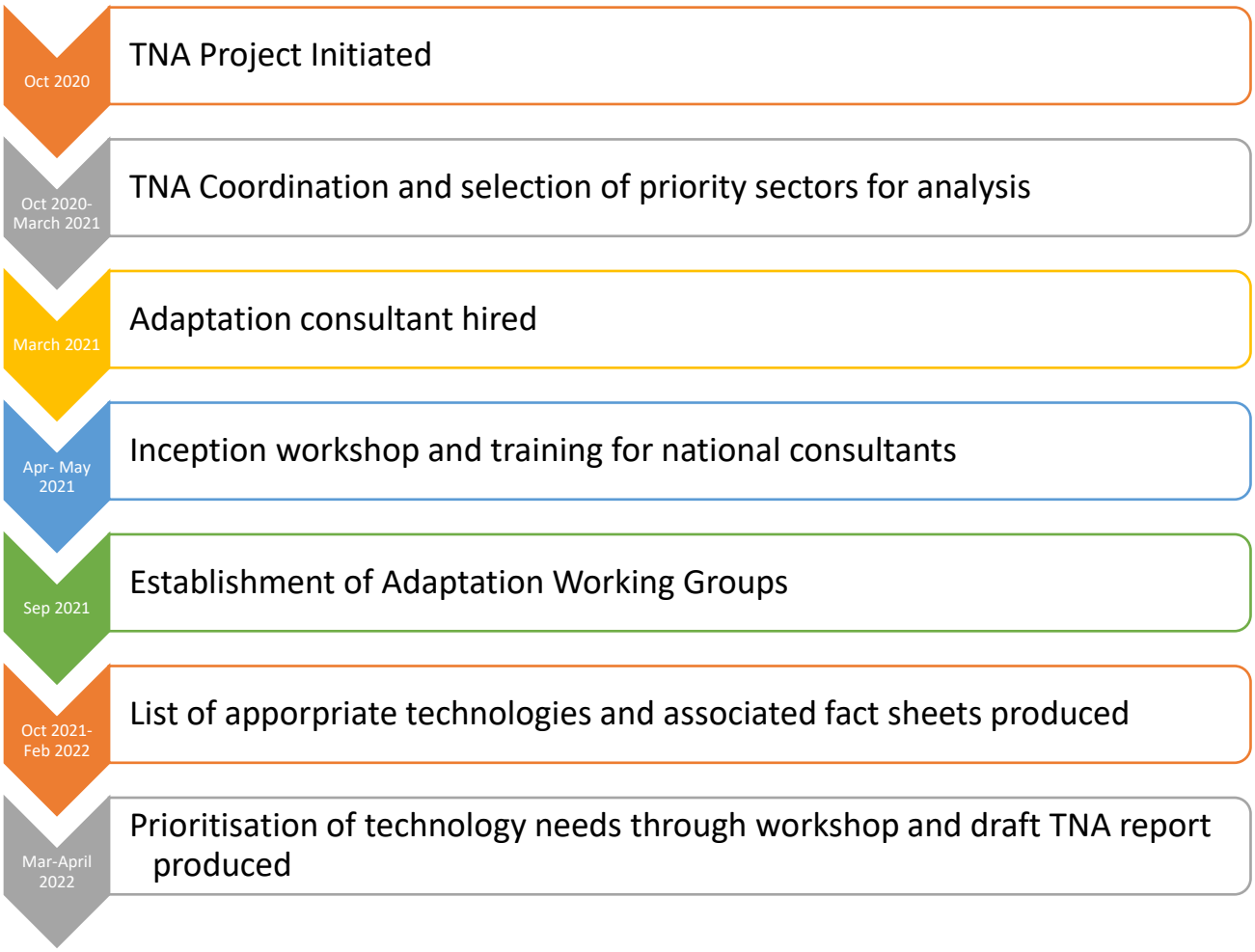
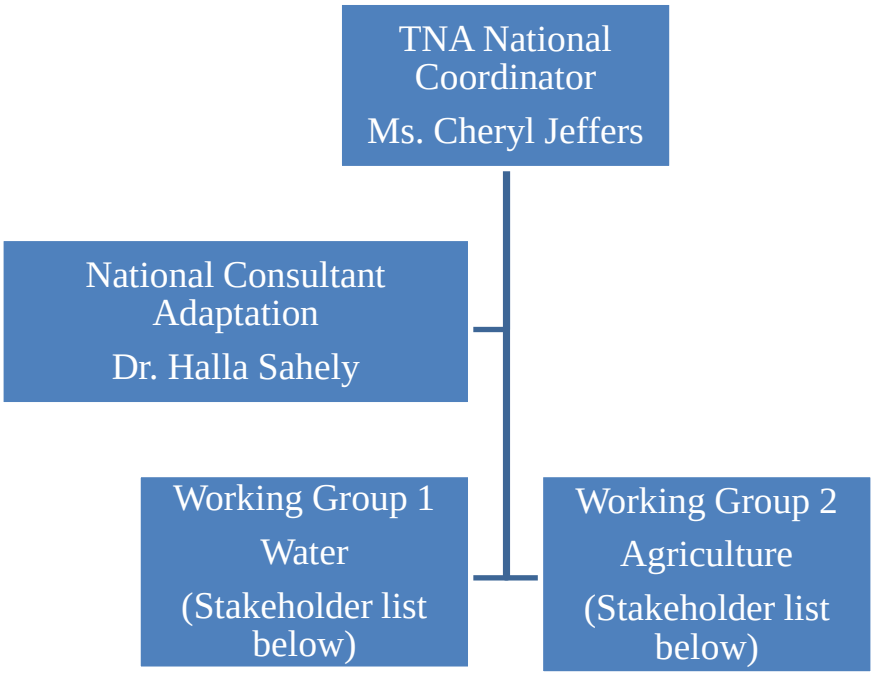


Figure 6.2- Institutional Arrangements for TNA Project



Stakeholders in Working Group 1 (Water)

Stakeholder	Responsibility
Integrated Water Resources Management Unit, Ministry of Communications, Nevis Island Administration	Responsible for the identification, upkeep, and protection of water supply sources on Nevis.
Water Services Department, Ministry of Public Infrastructure, Utilities, Posts and Urban Development	Maintains control over water production and distribution.
Private Sector – Waterworks Solutions Inc.	Provision of services to the water sector including installation of water distribution and storage systems.

Stakeholders in Working Group 2 (Agriculture)

Stakeholder	Responsibility
Nevis Department of Agriculture, Ministry of Agriculture	Provides technical support that is needed to ensure that the citizens and residents of the Federation are food and nutritionally secured through various initiatives and programmes.

Department of Agriculture, Ministry of Agriculture, Fisheries and Marine Resources	Provides technical support that is needed to ensure that the citizens and residents of the Federation are food and nutritionally secured through various initiatives and programmes.
Private sector – agriculture consultant	Provision of services to the agricultural sector through consultancy services.
GEF – Small Grants Programme / UNDP GEF-SGP	Provides financial and technical support to community-based projects that conserve and restore the environment while enhancing well-being and livelihoods. Further, the National Coordinator for the GEF-SGP is an Agronomist by profession was able to provide technical support to the process.

In St. Kitts and Nevis, priority sectors for the TNA were chosen due to their importance to the overall socioeconomic wellbeing of the Party as well as the need for prompt and effective adaptation actions. Stakeholders from the private sector, public sector and NGOs were identified in the chosen priority sectors of water and agriculture to participate in working groups to assist in the identification of relevant technologies based on their expertise and knowledge of national circumstance. The working groups, through a series of consultations, assisted in whittling down the list of potential adaptation technologies for each sector that was compiled by the national adaptation TNA consultant based on review/analysis of national policies, strategies, submitted UNFCCC reports and stakeholder consultation.

Water Sector - Adaptation

An extensive list of technological options was prepared for the water sector with technologies grouped into the following categories:

- Water conservation
- Water quality control
- Improved knowledge of water resources and its demand
- Diversification of water supply
- Stormwater management

Of the 27 possible technologies, 10 were initially identified with 9 identified for consideration (refinement of initial list and removal of one action) based on surveys with the water working group. See Table 6.4 for water sector technologies listed for prioritisation.

Table 6.4 - Initial Prioritisation list of Technologies in Water Sector (Adapted from TNA)

No	Technology Category	Specific Technology
1	Water Conservation	Leakage detection and repair and pressure management
2		Non-revenue water and demand management programme and smart metering
3	Improved knowledge of water resources and demand	Groundwater assessment, mapping, modelling and development
4		Water safety plans
5		Real-time data monitoring / GIS / SCADA
6		Integrated Water Resources Management
7		Enhanced potable water storage
8	Diversification of Water Supply	Stormwater catchment
9		Desalination

Multicriteria analysis was completed by the sectoral working group using agreed criterion and weights for the water sector. See below for Table 5 on agreed criterion and weights for the water sector. Based on the weighted scores, the prioritised list of adaptation technologies for the water sector is St. Kitts and Nevis are:

(1) Non-revenue water and demand management programme (including smart- metering)
(2) Leakage detection and repair and pressure management
(3) Integrated water resources management

Table 6.5 - Agreed criterion and weights for the water sector (Adapted from TNA)

Category	Criteria	Description	Weight
Costs	Capital	Costs of set-up of the technology generally incurred during start-up phase.	10

Category	Criteria	Description	Weight
	Operational and Maintenance	Costs of the technology over time, which encompasses the operational costs as well as the maintenance of the technology.	10
Economic Benefits	Improve economic performance	Technologies should aim to improve economic performance in the water sector including aspects of increasing productivity as well as generating interest and demand in the market for its output.	20
Social Benefits	Build technical capacity	This criterion assesses the effect of technologies in building the technical capacity of target beneficiaries.	10
	Improve health	This criterion is associated with health improvements to the population that is affected by the technology improvements. Such technology should ideally reduce morbidity and mortality rates resulting from climate change.	10
Environmental Benefits	Protect environmental (water) resources	Water quality, quantity and integrity needs to remain intact, and at best improved following the introduction of the technology.	15
Climate-related Benefits	Reduces vulnerability to climate change impacts	Adaptation to climate change works towards reducing the vulnerability of populations facing climate change and building their resilience to cope with the impacts.	15
Technology-related Benefits	Ease of implementation / Replicability / Appropriateness	The technology should be easy to implement and replicate and be appropriate to conditions on the ground.	10

Agriculture Sector - Adaptation

Review of the St. Kitts and Nevis adaptation chapter for the TNC provided a summary of existing technologies in the aforementioned sector. Based on these current identified technologies and the proposed list of actions identified in the NDC, an extensive list of technology options was prepared and grouped into the following categories:

- Crop management
- Livestock management
- Sustainable farming systems
- Sustainable water use/management
- Sustainable waste management
- Planning for climate change and variability
- Soil conservation and management
- Capacity building and stakeholder organisation
- Post-harvest/processing/distribution

Of the 34 possible technologies, a short list of 10 were identified for potential prioritisation. See Table 6.6 for agriculture sector technologies listed for prioritisation.

Table 6.6 - Initial Prioritisation list of Technologies in Agriculture Sector (Adapted from TNA)

No	Technology Category	Specific Technology
1	Crop management	Integrated Pest Management
2		Crop diversification and new varieties
3		Plant tissue culture
4	Livestock management	Livestock disease management including selective livestock breeding
5		Livestock feed production
6	Sustainable farming systems	Agrosilviculture
7		Soilless Agriculture / Aquaponics / Hydroponics

8	Soil conservation and management	Soil moisture conservation monitoring and techniques
9		Integrated soil nutrient management
10	Post-harvest / processing / distribution	Food storage, preservation, and processing

Multicriteria analysis was completed by the sectoral working group using agreed criterion and weights for the agriculture sector. See below for Table 6.7 on agreed criterion and weights for the agriculture sector. Based on the weighted scores, the prioritised list of adaptation technologies for the agriculture sector in St. Kitts and Nevis are:

(1) Integrated pest management
(2) Soil moisture conservation monitoring and techniques
(3) Agrosilviculture

Table 6.7- Agreed criterion and weights for the agriculture sector (Adapted from TNA)

Category	Criteria	Description	Weight
Costs	Capital	Costs of set-up of the technology generally incurred during start-up phase.	10
	Operational and Maintenance	Costs of the technology over time, which encompasses the operational costs as well as the maintenance of the technology.	10
Economic Benefits	Improve economic performance	Technologies should aim to improve economic performance in the agriculture sector including aspects of increasing crop and livestock productivity as well as generating interest and demand in the market for its output.	20
Social Benefits	Build technical capacity	This criterion assesses the effect of technologies in building the technical capacity of target beneficiaries.	10
	Improve health	This criterion is associated with health improvements to the population that is affected	10

Category	Criteria	Description	Weight
		by the technology improvements. Such technology should ideally reduce morbidity and mortality rates resulting from climate change.	
Environmental Benefits	Support to ecosystems services	This criterion assesses how the given technology contributes to supporting ecosystem services - broadly categorised into provisioning, regulating, supporting and cultural services. Provisioning services relate to the production of food and water. Regulating services relate to regulation of climate and disease/pest control. Supporting services relate to nutrient cycles, seed dispersal, and pollination, where cultural ecosystem services relate to the spiritual and recreational benefits.	15
Climate-related Benefits	Reduces vulnerability to climate change impacts	Adaptation to climate change works towards reducing the vulnerability of populations facing climate change and building their resilience to cope with the impacts.	15
Technology-related Benefits	Ease of implementation / Replicability / Appropriateness	The technology should be easy to implement and replicate and be appropriate to conditions on the ground.	10

Identified Mitigation Technology Needs

The following list of technology needs were identified through the mitigation assessment conducted in St. Kitts and Nevis during the TNC reporting cycle in consultation with relevant stakeholders:

- Solar water heaters installation
- Technology to undertake assessment of electric and hybrid vehicles integration
- Technology to undertake assessment of charging infrastructure for electric vehicles into the transmission and distribution grid and its impacts
- Technology to undertake geothermal assessments for St. Kitts
- Technology to assess and implement grid-interconnection between the two islands
- Monitoring systems for electric and hybrid vehicles
- Technology to assess for vehicle efficiency

- Wind technology assessments
- Data collection and monitoring systems
- Energy efficient equipment
- Knowledge exchange for electricity legislation
- Technology to assess the impact of improve public transit
- Technology to assess the possibilities of enabling conditions for EV uptake
- Technology to improve public awareness programmes
- Technology to assess building usage data

At the time of writing, no prioritisation of mitigation needs was conducted. The government of St. Kitts and Nevis intends to compare the list identified above with the output of the TNA mitigation project to ensure that all potential technologies identified are prioritised by need and feasibility.

6.4 Support needed

An assessment and quantification of support needed has not yet been conducted for the prioritised needs identified during the TNC/BUR1 reporting cycle for St. Kitts and Nevis. Across all areas of climate MRV in St. Kitts and Nevis: technology transfer, capacity-building, and financial support is needed as soon as possible. Prioritised needs for GHGI, Mitigation, Adaptation and MRV that require support are identified in Table 2.

6.5 Support received

Support received for the preparation of BUR1

St. Kitts and Nevis received multilateral financial support from the GEF in the amount of 852,0000 (USD) to develop its first BUR (352,000 USD) and its Third National Communication (500,000 USD). The funding was administered through the Global Environment Facility (GEF) with the United Nations Environment Programme (UNEP) having the responsibility as the Implementing Agency, and the Department of Environment in the Ministry of The Environment and Cooperatives serving on behalf of the Government of St. Kitts and Nevis, as the Executing Agency. The funding was used to contract the Caribbean Cooperative MRV Hub, Stockholm Environment Institute (SEI), ESSA Technologies Limited, Island Planning Services, Greenhouse Gas Management Institute and RELATE Consultancy.

7. ANNEXES

Table A1: Data for Figure 5. 26. Population (a) and household *(b) trends to 2050*

Year	Population (Thousand persons)
2020	53.19
2022	53.86
2024	54.47
2026	54.99
2028	55.44
2030	55.83
2032	56.15
2034	56.40
2036	56.57
2038	56.69
2040	56.73
2042	56.72
2044	56.67
2046	56.55
2048	56.38
2050	56.16

Table A2: Data for Figure 2. household (b) trends to 2050

Year	Households (Thousands)
2020	23.54
2022	24.48
2024	24.76
2026	24.99
2028	25.20
2030	25.38
2032	25.52
2034	25.64
2036	25.71
2038	25.77
2040	25.79
2042	25.78
2044	25.76
2046	25.71
2048	25.63
2050	25.53

Table 453: Data for Figure 5.27. GDP (a) and GDP per capita (b) trends to 2050 trends to 2050

Year	GDP/Million EC$
2008	1,959.09
2011	1,902.49
2014	2,083.44
2017	2,209.01
2020	1,972.98
2023	2,257.66
2026	2,446.16
2029	2,649.69
2032	2,893.87
2035	3,154.30
2038	3,424.55
2041	3,704.36
2044	3,999.71
2047	4,297.67
2050	4,611.12

Table 46: Data for Figure 5.27. GDP (a) and GDP per capita (b) trends to 2050

Year	GDP per Capita EC$/Capita
2008	41.74
2011	40.31
2014	41.50
2017	42.45
2020	37.09
2023	41.67
2026	44.49
2029	47.61
2032	51.54
2035	55.84
2038	60.41
2041	65.29
2044	70.58

2047	76.10
2050	82.11

Table A5-Data for Figure 5.28. Projected GHG emissions in the baseline by sector

	Ag and Fisheries {1A4c}	Agriculture	Electricity Generation	Fugitive Emissions	Industry {1A2}	LULUCF	Residential {1A4b}	Services {1A4a}	Transportation {1A3}	Waste	Total
2008	0.4	20.4	154.4	0.0	4.4	-65.8	4.2	8.1	70.5	41.5	238.3
2012	0.3	10.6	169.2	0.0	4.4	-90.5	4.4	3.3	56.1	51.8	209.7
2016	0.3	8.3	178.2	0.0	5.4	-113.1	4.6	1.8	88.3	56.7	230.5
2020	0.3	8.2	167.2	0.0	5.1	-113.1	4.9	1.7	107.1	59.8	241.1
2024	0.3	9.7	189.5	0.0	5.9	-113.1	4.9	1.6	125.9	61.2	285.8
2028	0.4	10.7	210.6	0.0	6.4	-113.1	4.8	1.4	140.0	62.3	323.5
2032	0.4	12.0	230.5	0.0	7.0	-113.1	4.6	1.2	157.0	63.1	362.9
2036	0.5	13.5	245.2	0.0	7.7	-113.1	4.5	1.1	175.8	63.6	398.7
2040	0.5	15.0	266.2	0.0	8.4	-113.1	4.3	1.0	195.8	63.7	442.0
2044	0.6	16.6	274.6	0.0	9.2	-113.1	4.1	0.9	216.9	63.7	473.4
2048	0.7	18.3	292.6	0.0	9.9	-113.1	3.9	0.8	238.8	63.3	515.1
2050	0.7	19.2	301.3	0.0	10.2	-113.1	3.8	0.7	250.1	63.1	536.1

Table A6: Data for Figure 29.5 Projected net GHG emissions in the baseline by gas

	Carbon Dioxide/ kt CO_2eq	Methane/ kt CO_2eq	Nitrous Oxide / kt CO_2eq	Total
2008	174.20	56.94	7.11	238.25
2010	169.66	64.22	6.72	240.60
2012	145.46	59.18	5.02	209.66
2014	142.12	60.25	5.20	207.57
2016	163.07	62.11	5.35	230.53
2018	179.91	64.40	6.76	251.07
2020	170.22	64.50	6.34	241.06
2022	191.63	65.72	6.83	264.19
2024	211.66	66.85	7.32	285.82
2026	228.43	67.76	7.67	303.86
2028	246.80	68.63	8.05	323.48
2030	265.21	69.45	8.47	343.13
2032	283.70	70.25	8.93	362.88
2034	301.31	70.99	9.42	381.72
2036	317.20	71.65	9.89	398.74
2038	332.45	72.27	10.39	415.11
2040	358.23	72.82	10.92	441.97
2042	368.45	73.32	11.42	453.19
2044	387.68	73.79	11.97	473.44
2046	407.52	74.19	12.51	494.22

2048	427.47	74.55	13.08	515.10
2050	447.54	74.87	13.65	536.05

Table A7: Data for Figure 5.30. Projected total net emissions in St. Kitts and Nevis under three scenarios and Figure 5.37. Projected total net emissions in St. Kitts and Nevis under three scenarios by 2050

Scenario	B_Baseline/ kt CO_2eq	C_Current mitigation actions/ kt CO_2eq	D_Additional mitigation actions/ kt CO_2eq	Total/ kt CO_2eq
2008	238.25	238.25	238.25	714.75
2010	240.60	240.60	240.60	240.60
2012	209.66	209.66	209.66	628.99
2016	230.53	230.53	230.53	691.59
2020	241.06	237.03	236.61	714.70
2024	285.82	255.99	253.92	795.73
2028	323.48	207.48	201.49	732.45
2030	343.13	159.37	148.66	651.16
2032	362.88	167.13	152.44	682.45
2036	398.74	138.70	104.77	642.21
2040	441.97	158.27	116.27	716.51
2044	473.44	175.14	107.75	756.33
2048	515.10	189.94	104.66	809.70
2050	536.05	198.57	103.85	838.48

Table A847: Data for Figure 5.31. Projected total net emissions by sector under three scenarios

Branch/kt CO_2-eq	Ag and Fisheries {1A4c}	Agriculture	Electricity Generation	Fugitive Emissions	Industry {1A2}	LULUCF	Residential {1A4b}	Services {1A4a}	Transportation {1A3}	Waste	Total
2010 BAS	0.34	20.39	170.93	0.00	4.22	-65.84	4.34	5.11	52.26	48.85	240.60
2010 CMIT	0.34	20.39	170.93	0.00	4.22	-65.84	4.34	5.11	52.26	48.85	240.60
2010 AMB	0.34	20.39	170.93	0.00	4.22	-65.84	4.34	5.11	52.26	48.85	240.60
2020 BAS	0.30	8.21	167.16	0.00	5.09	-113.10	4.88	1.67	107.08	59.77	241.06
2020 CMIT	0.30	8.21	163.49	0.00	5.09	-113.10	4.88	1.67	106.72	59.77	237.03
2020 AMB	0.30	8.21	164.81	0.00	5.09	-113.10	4.88	1.67	104.98	59.77	236.61
2030 BAS	0.41	11.36	221.00	0.00	6.70	-113.10	4.71	1.31	148.00	62.73	343.13
2030 CMIT	0.41	11.36	46.21	0.00	6.70	-116.49	4.71	1.31	143.40	61.75	159.37
2030 AMB	0.41	11.36	54.03	0.00	6.70	-116.49	4.71	1.31	124.87	61.75	148.66
2035 BAS	0.47	13.13	243.00	0.00	7.55	-113.10	4.51	1.14	171.09	63.47	391.27
2035 CMIT	0.47	13.13	0.56	0.00	7.55	-116.49	4.51	1.14	160.92	62.48	134.28
2035 AMB	0.47	13.13	3.10	0.00	7.55	-116.49	4.51	1.14	127.05	62.48	102.95

Table A9: Data for Figure 5.32. Projected total net emissions by gas under three scenarios

GHG/kt CO_2-eq	Carbon Dioxide	Methane	Nitrous Oxide	Total
2010 BAS	169.66	64.22	6.72	240.60
2010 CMIT	169.66	64.22	6.72	240.60
2010 AMB	169.66	64.22	6.72	240.60
2020 BAS	170.22	64.50	6.34	241.06
2020 CMIT	166.21	64.50	6.32	237.03
2020 AMB	165.85	64.50	6.27	236.61
2030 BAS	265.21	69.45	8.47	343.13
2030 CMIT	83.12	68.27	7.99	159.37
2030 AMB	72.81	68.25	7.60	148.66
2035 BAS	310.29	71.33	9.65	391.27
2035 CMIT	55.32	70.05	8.91	134.28
2035 AMB	24.76	70.00	8.19	102.95

Table A10: Data for Figure 5.33. Projected emission reductions by sector in the mitigation scenario compared to the baseline

Technology/MW	Solar	Wind	Geothermal	Thermal	Total
BAS 2020	0.50	1.93	-	70.40	72.83
BAS 2030	0.50	1.93	-	54.80	57.23
BAS 2035	0.50	1.93	-	58.80	61.23
BAS 2050	-	-	-	77.50	77.50
CMIT 2020	0.50	1.93	-	70.40	72.83
CMIT 2030	36.20	8.53	10.00	54.80	109.53
CMIT 2035	36.20	8.53	25.00	35.30	105.03
CMIT 2050	59.40	29.60	25.00	4.00	118.00
AMB 2020	0.50	1.93	-	70.40	72.83
AMB 2030	36.20	8.53	10.00	54.80	109.53
AMB 2035	36.20	8.53	25.00	35.30	105.03
AMB 2050	76.70	47.60	25.00	4.00	153.30

Table A11: Data for Figure 5.34. Projected emission reductions by sector in the mitigation scenario with additional actions compared to the baseline

Technology/GWh	Solar	Wind	Geothermal	Thermal	Total
BAS 2020	0.96	4.89	-	231.10	236.95
BAS 2030	0.96	4.89	-	290.81	296.66

BAS 2035	0.96	4.89	-	320.38	326.24
BAS 2050	-	-	-	416.58	416.58
CMIT 2020	0.96	4.89	-	226.02	231.88
CMIT 2030	69.51	21.63	70.14	63.89	225.17
CMIT 2035	69.45	21.62	131.12	0.77	222.97
CMIT 2050	99.06	71.70	109.43	1.98	282.17
AMB 2020	0.96	4.89	-	227.85	233.70
AMB 2030	69.73	21.65	72.61	74.70	238.68
AMB 2035	69.76	21.66	148.84	4.29	244.55
AMB 2050	113.92	111.24	103.09	2.54	330.79

Table A1248: Data for Figure 5.35. Current and projected power generation capacity under three scenarios

Branch /$ktCO_2$-eq	""B_Baseline""	Ag and Fisheries {1A4c}	Agriculture	Electricity Generation	Fugitive Emissions	Industry {1A2}	LULUCF	Residential {1A4b}	Services {1A4a}	Transportation {1A3}	Waste	Total
2008	238.25	-	-	-	-	-	-	-	-	-	-	238.25
2010	240.6	-	-	-	-	-	-	-	-	-	-	240.6
2011	221.25	-	-	-	-	-	-	-	-	-	-	221.25
2014	207.57	-	-	-	-	-	-	-	-	-	-	207.57
2017	240.17	-	-	-	-	-	-	-	-	-	-	240.17
2020	241.06	-	-	-3.67	-	-	-	-	-	-0.36	-	237.03
2023	277.98	-	-	-19.41	-	-	-0.75	-	-	-1.03	-0.21	256.57
2026	303.86	-	-	-93.29	-	-	-1.88	-	-	-2.31	-0.53	205.85

2029	332.7	-	-	-116.43	-	-	-3.02	-	-	-4	-0.87	208.38
2030	343.13	-	-	-174.78	-	-	-3.39	-	-	-4.6	-0.98	159.37
2032	362.88	-	-	-184.65	-	-	-3.39	-	-	-6.72	-0.98	167.13
2035	391.27	-	-	-242.44	-	-	-3.39	-	-	-10.17	-0.99	134.28
2038	415.11	-	-	-248.82	-	-	-3.39	-	-	-13.94	-0.99	147.96
2041	448.02	-	-	-262.29	-	-	-3.39	-	-	-18.11	-0.99	163.23
2044	473.44	-	-	-271.16	-	-	-3.39	-	-	-22.76	-0.99	175.14
2047	504.56	-	-	-286.91	-	-	-3.39	-	-	-27.77	-0.99	185.5
2050	536.05	-	-	-299.9	-	-	-3.39	-	-	-33.2	-0.98	198.57

Table A13: Data for Figure 5.36. Current and projected power generation under three scenarios

Branch/ktCO$_2$-eq	""B_Baseline""	Ag and Fisheries {1A4c}	Agriculture	Electricity Generation	Fugitive Emissions	Industry {1A2}	LULUCF	Residential {1A4b}	Services {1A4a}	Transportation {1A3}	Waste	Total
2008	238.25	-	-	-	-	-	-	-	-	-	-	238.25
2012	209.66	-	-	-	-	-	-	-	-	-	-	209.66
2016	230.53	-	-	-	-	-	-	-	-	-	-	230.53
2020	241.06	-	-	-3.67	-	-	-	-	-	-0.36	-	237.03
2024	285.82	-	-	-27.12	-	-	-1.13	-	-	-1.27	-0.32	255.99
2028	323.48	-	-	-109.18	-	-	-2.64	-	-	-3.42	-0.75	207.48
2032	362.88	-	-	-184.65	-	-	-3.39	-	-	-6.72	-0.98	167.13
2036	398.74	-	-	-244.27	-	-	-3.39	-	-	-11.38	-0.99	138.7
2040	441.97	-	-	-262.66	-	-	-3.39	-	-	-16.66	-0.99	158.27
2044	473.44	-	-	-271.16	-	-	-3.39	-	-	-22.76	-0.99	175.14
2048	515.1	-	-	-291.25	-	-	-3.39	-	-	-29.54	-0.99	189.94
2050	536.05	-	-	-299.9	-	-	-3.39	-	-	-33.2	-0.98	198.57

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