Assessment of Short-Lived Climate Pollutant mitigation in the Dominican Republic: Recommendations for NDC enhancement

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Assessment of Short-Lived Climate Pollutant mitigation in the Dominican Republic: Recommendations for NDC enhancement

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Contents

1. Introduction

Air pollution and climate change are two of the biggest environmental issues that are faced globally. Exposure to air pollution from indoor and outdoor sources, was associated with 6.7 million premature deaths in 2019 from respiratory and cardiovascular diseases, and lung cancer (Murray et al., 2020). It is also linked with other non-fatal health impacts, such as adverse pregnancy outcomes (Malley et al., 2017), asthma (Anenberg et al., 2018), and emergency room visits (REVIHAAP, 2013). The two pollutants that have the largest effects on human health are fine particulate matter ($PM_{2.5}$) and tropospheric ozone (O_3). In 2019 in Dominican Republic, 4,700 premature deaths were associated with exposure to air pollution (Murray et al., 2020[1]) .

At the same time, emissions are warming the atmosphere. Since preindustrial times, global average temperatures have increased by 1.1°C (IPCC, 2018), with the Paris Agreement setting the goal of limiting global average temperature increases to ‘well below 2°C’, and ideally to 1.5°C (United Nations, 2015). Current climate change commitments are estimated to be consistent with over 3°C of warming by 2100 (Jeffery et al., 2018), and therefore more action is needed to meet the goals of the Paris Agreement and meet these temperature goals. Impacts of climate change include increased frequency of extreme weather events, such as storms, flood, droughts and heatwaves, impacts on agriculture and food security, impacts on human health, and on biodiversity (IPCC, 2019a, 2018).

The issues of climate change and air pollution are closely linked because, i) in many cases greenhouse gases and air pollutants are emitted from the same sources (Myhre et al., 2013; Priddle, 2016), and ii) some of the same substances contribute to climate change, and to air pollution impacts, such as methane, black carbon and tropospheric ozone, i.e the Short-lived Climate Pollutants (SLCPs) (Figure 1). These two linkages provides substantial opportunity to design strategies and identify mitigation measures that can simultaneously air pollution and mitigate climate change. Global and regional studies have shown that there are a variety of strategies and actions that can be taken to target the major sources of SLCPs and simultaneously improve air pollution locally while reducing a countries contribution to global climate change (Kuylenstierna et al., 2020; Nakarmi et al., 2020; Shindell et al., 2012; Stohl et al., 2015; UNEP/WMO, 2011; UNEP, 2019, 2018).

[1] https://vizhub.healthdata.org/gbd-compare/

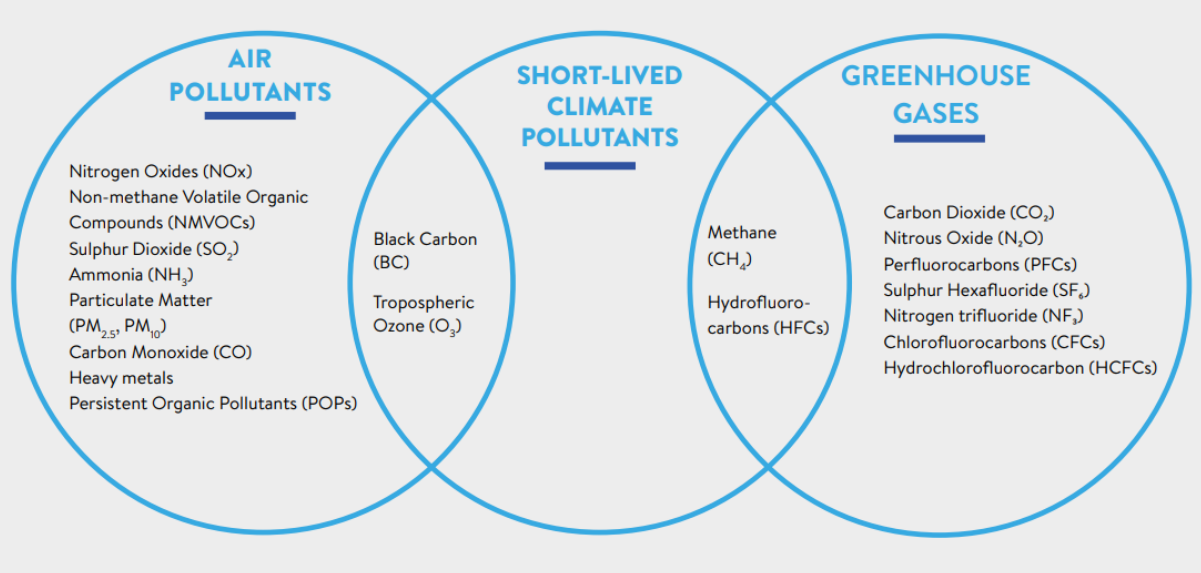

Figure 1: Summary of pollutants that are classified as air pollutants, short-lived climate pollutants and greenhouse gases (Source: CCAC SNAP, 2019)

The UNEP/WMO (2011) Integrated Assessment of Black Carbon and Tropospheric Ozone was a global assessment of the benefits of taking actions to reduce black carbon and tropospheric ozone. Mitigation measures that targeted the main sources of black carbon and the main sources of methane (a precursor of tropospheric ozone) were evaluated in terms of their impacts on air quality and on climate. In total, 16 measures were identified that provided 90% of the climate benefits from the hundreds of measures that were evaluated. These included 9 measures that targeted black carbon, including measures in the residential, agriculture, transport and industry sectors, and 7 measures that targeted methane in the agriculture, oil and gas and waste sectors (Chapter 4 includes a complete description of these measures).

The Assessment calculated that the full implementation of these measures would yield substantial air quality and climate benefits, estimating that by 2.4 million premature deaths would be avoided in 2030 compared to the baseline, as well as 52 million additional tonnes of 4 staple crops (rice, wheat, maize and soy) due to less crop damage from ozone exposure. These air quality benefits are disproportionately achieved locally, in those countries and regions where the emission reductions occur.

At the same time, implementation of these measures would also avoid 0.5°C of global temperature increase, making an important contribution to limiting global temperature rises when combined with fast and ambitious CO2 mitigation (Figure 2). Black carbon, methane and tropospheric ozone, together with hydrofluorocarbons, have been called ‘short-lived climate pollutants’ because of the relatively short time they spend in the atmosphere once emitted (days to a two decades), and their impacts on climate and air quality (except for HFCs, which just impact climate). This means that actions on SLCPs can quickly produce multiple benefits for air quality and climate change (Shindell et al., 2012).

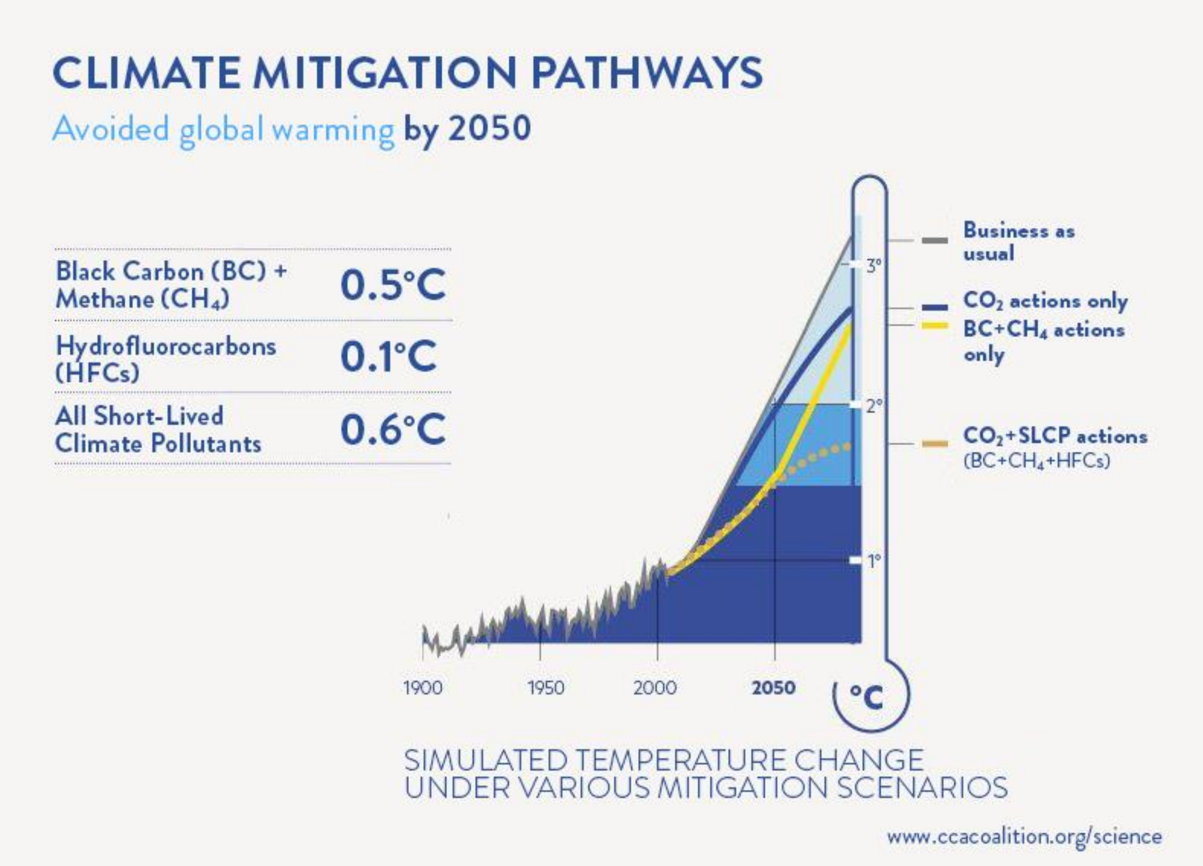

Figure 2: Overview of climate change benefits from taking action on short-lived climate pollutants

It is important to note that the benefits that are achieved by the measures that target SLCP source sectors are achieved for two reasons. Firstly, it is because they reduce SLCPs themselves, which, in the case of black carbon and methane have direct impacts on both air quality and on climate. But it is also because many of the SLCP source sectors are also major sources of greenhouse gases (e.g. CO_2) and other air pollutants. Therefore, the implementation of mitigation measures in these sectors can also reduce emissions of greenhouse gases and other air pollutants, in addition to reducing SLCPs.

Nationally Determined Contributions (NDCs) that are submitted by national governments to the United Nations Framework Convention on Climate Change (UNFCCC) outline a country's contribution to achieving the global goals of limiting global temperature increases to no more than 2 ^{O}C, as all countries committed to in the Paris Agreement. In 2020, many countries, including Dominican Republic, are updating their NDC compared to what was submitted to in 2015 (Pauw and Klein, 2020). The inclusion within NDCs of action that target the main sources of SLCPs, and which improve air quality can contribute to i) increasing climate change mitigation ambition, and ii) maximize local benefits from NDC implementation and achieving a country's climate change commitment (CCAC SNAP, 2019).

The aim of this document is to provide an overview of short-lived climate pollutants and air pollutants in the Dominican Republic, and to provide recommendations as to how actions to reduce SLCPs could be incorporated into the updated NDC of Dominican Republic. Specifically, the objectives of this document are:

- To present the **first integrated GHG, SLCP and air pollutant emission inventory** for Dominican Republic, covering 2010-2018.
- To assess how emissions of Short-lived climate pollutants are likely to change into the future for a **baseline scenario.**
- To evaluate and quantify the potential to reduce short-lived climate pollutant emissions for different **policies and measures** designed to reduce emissions from key source sectors.
- To provide recommendations as to how Short-lived climate pollutants and air pollution benefits can be included in the NDC update of Dominican Republic, and more generally on how the integration of air pollution and climate change mitigation could be strengthened in Dominican Republic.

The following sub-sections first describe the results from an emission inventory of short-lived climate pollutants in Dominican Republic between 2010 and 2018 (Section 2). This section details the main contribution of different source sectors to SLCPs, air pollutant and greenhouse gas emissions. Section 3 then identifies relevant mitigation options for SLCPs, based on discussions with the National Climate Change Council and Ministry of Environment (Section 3). This section quantifies the emission reductions achievable from the implementation of the mitigation measures identified Finally, recommendations as to how action on SLCP and air pollutant mitigation could be taken forward based on the results of the analysis are presented in Section 4. Detailed technical descriptions of the emission inventory are included as a technical annex.

2. Emissions of Short-Lived Climate Pollutants in Dominican Republic 2010-2018

Exposure to air pollution, and the resultant health impacts, occurs due to emissions of a variety of different gases and particles, from a range of different emission sources. In addition, greenhouse gases and SLCPs are also emitted from a wide variety of sources (often the same as air pollutants). Therefore, a first step in the development of strategies to reduce SLCPs, improve air pollution while also mitigating climate change is to develop a first inventory of the magnitude of emissions of GHGs, SLCPs and air pollutants, using a consistent methodology and approach to ensure consistency of the emission estimates. An emission inventory can be used to identify the major sources of emissions of different pollutants. It can be the starting point for the identification of where action is needed to reduce emissions and can be regularly updated to track the level of emissions over time.

Understanding the contribution of different source sectors is also a starting point to identifying priority actions that can be taken to reduce SLCPs, improve air quality and mitigate climate change. This section therefore presents the first estimates of SLCP and air pollutant emissions in the Dominican Republic for 2010-2018. Technical Annex 1 provides a detailed description of the data, methods and assumptions used to develop the emission inventory. A summary is presented in Section 2.1, and the emission estimates are included in Section 2.2.

2.1 Sources and pollutants covered in inventory

The key equation used to estimate emissions from all major sources of the pollutants listed above is the multiplication of an *activity* variable multiplied by an *emission factor* (Equation 1). The activity variable quantifies how big a particular sector or process is in a country (e.g. the number of Terajoules of fuel consumed in a particular sector, the number of tonnes of production of a particular mineral, chemical or other product). Emission factors quantify the mass of pollutant emitted per unit of activity (e.g. the kilogrammes of black carbon emitted per Terajoule of fuel consumed).

$$Emissions = Activity \; x \; Emission \; Factor \qquad \text{Eq. 1}$$

The specific activity data, emission factors and methodologies used to quantify emissions in each source sectors are defined according to international guidelines on the quantification of GHG and air pollutant emissions. Specifically, the methodologies follow the Intergovernmental Panel on Climate Change (IPCC) 2006 emission inventory guidelines. The Intergovernmental Panel on Climate Change (IPCC, 2019b, 2006) guidelines provide methodologies for the quantification of GHG emissions. They also recommend that for other pollutants, the EMEP/EEA (2019) air pollution emission inventory guidebook is used. These methodologies (predominantly the most simple 'Tier 1' methods) were followed to develop this inventory, and are described in detail for each sector in Technical Annex 1.

Pollutants Included

The purpose of the integrated short-lived climate pollutant (SLCP), greenhouse gas (GHG) and air pollutant emission inventory is to characterize the emissions of pollutants that contribute to global temperature increases, and to air pollution and its effects on human health. Therefore, the pollutant characterized in this inventory are those that are greenhouse gases, like carbon dioxide and methane, and those pollutants that contribute to the formation of particulate matter (PM), and tropospheric ozone (O_3). These are the two pollutants that have the largest effect on human health, and therefore the pollutants whose emissions are quantified in this emission inventory make the largest contribution to air pollution in Dominican Republic, as well as Dominican Republic's contribution to global climate change. The emission inventory of short-lived climate pollutants, greenhouse gases and air pollutants covers 11 pollutants in total, including:

Short-Lived Climate Pollutants

- **Black carbon (BC):** A component of direct particulate matter (PM) emissions that contributes to the negative effects of air pollution on human health. Emissions of black carbon also warm the atmosphere through direct absorption of incoming solar radiation, and through indirect effects such as deposition on snow and ice and cloud interactions. With an atmospheric lifetime of a few days, it is a short-lived climate pollutant. It is mainly emitted through incomplete combustion.

- **Methane (CH_4):** A greenhouse gas and short-lived climate pollutant with an atmospheric lifetime of approximately 15 years, methane emissions make the second largest contribution to global temperature increases after carbon dioxide. It also contributes to the formation of tropospheric ozone (O_3), which has negative effects on respiratory health and crop yield.

Air Pollutants

- **Particulate Matter ($PM_{2.5}$ and PM_{10}):** Particulate matter (with aerodynamic diameter less than 2.5 µm ($PM_{2.5}$) and 10 µm (PM_{10})) are small solid particles in the atmosphere. They make the largest contribution to air pollution effects on human health through effects on the cardiovascular and respiratory systems. The emissions of $PM_{2.5}$ and PM_{10} calculated here represent the direct emissions to the atmosphere of particulate matter. However, other gaseous pollutants, like Nitrogen oxides, Sulphur dioxide, ammonia and volatile organic compounds, also contribute to the $PM_{2.5}$ and PM_{10} concentrations that people are exposed to, through chemical reactions in the atmosphere that convert gaseous pollutants into solid particles.
- **Nitrogen Oxides (NO_x):** An air pollutant which is a precursor to the formation of particulate matter and tropospheric ozone, NO_x is made up of two pollutants, nitrogen oxide (NO) and nitrogen dioxide (NO_2).
- **Sulphur dioxide (SO_2):** An air pollutant which is a precursor to the formation of particulate matter.
- **Ammonia (NH_3):** An air pollutant which is a precursor to the formation of particulate matter.
- **Organic Carbon (OC):** A component of direct particulate matter (PM) emissions that contributes to the negative effects of air pollution on human health.
- **Non-methane volatile organic compounds (NMVOCs):** A collection of a range of different organic molecules emitted from a range of emission sources. NMVOCs are precursors to the formation of tropospheric ozone and particulate matter.
- **Carbon monoxide (CO):** A gaseous air pollutant which contributes to the formation of tropospheric ozone.

Greenhouse Gases

- **Carbon dioxide (CO_2):** A greenhouse gas with an atmospheric lifetime of hundreds of years, that makes the largest contribution to global climate change.

Source sectors

The emission sources covered in the inventory cover all the major sources of SLCPs and air pollutants, and greenhouse gases, with the exception of land-use and land-use change emissions. Emission sources were grouped according to the IPCC source categories. The source sectors covered are described in Table 1.

Table 1: Source sectors covered in emission inventory

Source Sector	Sub-sectors
1 - Energy	1A1a Public Electricity and Heat Production

	1A1c Manufacture of Solid Fuels and Other Energy Industries
	1A2 Manufacturing Industries and Construction
	1A3b Road transportation
	1A3c Railways
	1A4a Commercial/Institutional
	1A4b Residential
	1A4c Agriculture, Forestry, Fishing
	1A5 Other
	1B1a Fugitive emissions from coal mining
	1B2 Fugitive emissions from oil and gas
2- Industrial Processes	2A Mineral Industry
	2B Chemical Industry
	2C Metal Industry
3 – Agriculture, Forestry and Other Land-Use	3A Livestock
	3C Aggregate sources and non-CO2 emission sources on land
	3D Other
4 - Waste	4A Solid Waste Disposal on Land

2.2 Emissions of SLCPs between 2010 and 2018

The total emissions of each pollutant estimated in this inventory is shown in Table 2 between 2010 and 2018. The total emissions of CO_2 are similar to those reported for in Dominican Republic's third National Communication (21910 Gigagrams in the TNC compared to 20,504 Gigagrammes in this study). However, the similarity of the results suggest consistency between the two inventories, which is expected as much of the same activity data used to estimate GHG emissions in the TNC are also used to estimate air pollutants and SLCPs in this work (see technical annex for further details). This provides a first-order check that the emissions of other pollutants are also consistent with official estimates of emissions in Dominican Republic.

In terms of SLCPs, in 2018 there were 2700 grams of black carbon emitted to the atmosphere in Dominican Republic. This value shows no large trend between 2010 and 2018. The major sources of black carbon emissions were from residential combustion, industry, transport and waste burning (Figure 4). Within the residential sector, the use of wood fuel in rural areas contributed the majority of black carbon emissions from this sector, which contributes not only to climate warming and outdoor air pollution but, can impact the health of those living in households using wood for cooking through indoor air pollution. In industry, the use of bagasse as a fuel was the largest source of black carbon emissions. The energy consumption in the industry sector was obtained from Dominican Republic's National Net Energy Balance for 2010-2018. The National Net Energy Balance does not include other sources of biomass that may be burned in industry, such as coconut ground, barley, wood, and rice husks. Due to a lack of emission control technologies in the industry sector, these other biomass fuels may be large black carbon emission sources, but are not quantified in this inventory, due to a lack of data on the magnitude of consumption of these fuels. Therefore, the black carbon emissions from inventory may be underestimated. In the transport sector diesel buses were the largest source (see technical Annex 1 for more detailed description of black carbon sources).

Methane emissions have also been relatively stable, increasing approximately 5% between 2010 and 2018. In this case agricultural emissions were the largest source of methane emissions, followed by the waste sector (Figure 5). In the agriculture sector, methane emissions from livestock enteric fermentation (predominantly cattle) was the largest source of methane emissions, while management of solid waste in landfills was the largest methane source in the waste sector.

The major source of black carbon are also major sources of air pollutants and greenhouse gases (Figure 3). For example, the waste and residential sectors are major sources of particulate matter emissions ($PM_{2.5}$, PM_{10}, organic carbon). The transport sector is a major source of carbon dioxide and NO_x emissions. Therefore, there is a large opportunity to identify actions and to develop strategies to reduce SLCPs that will simultaneously improve air quality and mitigate climate change.

Table 2: Total national emissions of GHGs, SLCPs and air pollutants in Dominican Republic between 2010 and 2018 (Gigagrams)

Pollutant	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbon Dioxide	20,504	20,779	21,593	22,173	23,687	24,880	25,864	24,709	26,050
Carbon Monoxide	366	376	403	398	416	438	398	402	428
Methane	347	357	369	375	384	394	404	406	410
Non Methane Volatile Organic Compounds	115	117	119	122	126	128	128	129	134
Nitrogen Oxides	62.7	60.2	62.4	68.4	69.1	71.9	76.4	74.5	74.0
Particulates PM10	41.2	41.9	40.8	43.4	44.3	48.3	42.8	43.8	45.4
Sulphur Dioxide	117	106	103	116	119	124	137	123	133
Particulates PM2pt5	34.6	35.0	34.2	36.4	37.2	40.5	35.9	36.7	38.0
Black Carbon	3.69	3.62	3.62	3.84	3.81	4.00	3.79	3.87	3.88
Organic Carbon	15.7	16.1	15.6	16.8	17.0	18.6	16.0	16.5	16.8

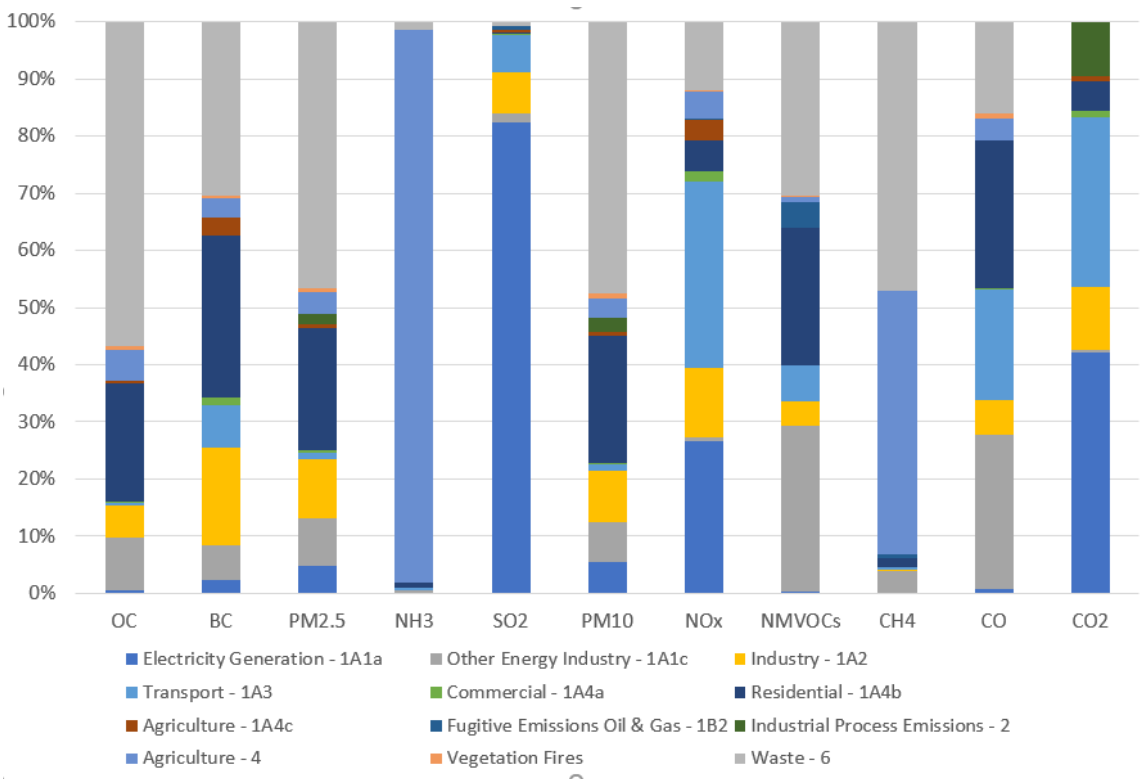

Figure 3: Contribution of different sources to SLCP, air pollutant and GHG emissions in Dominican Republic in 2018

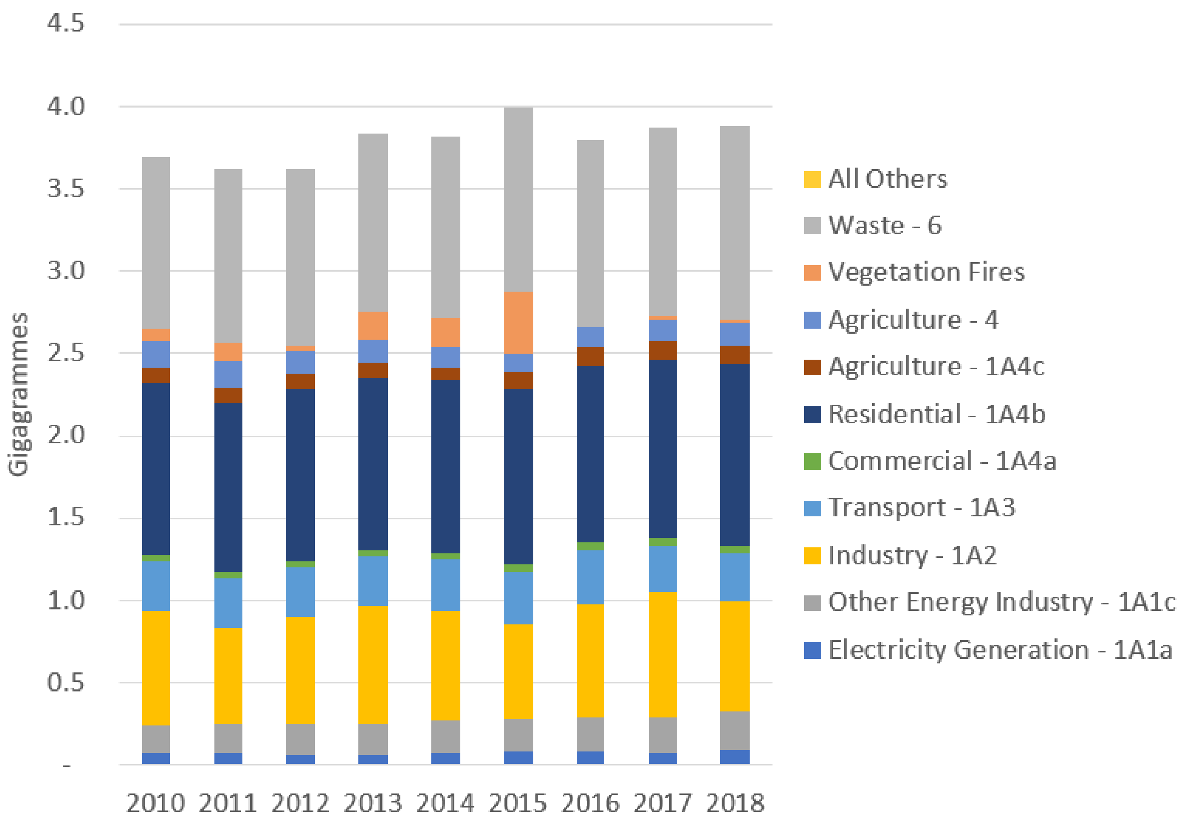

Figure 4: Black carbon emissions in Dominican Republic between 2010 and 2018 (units: gigagrams)

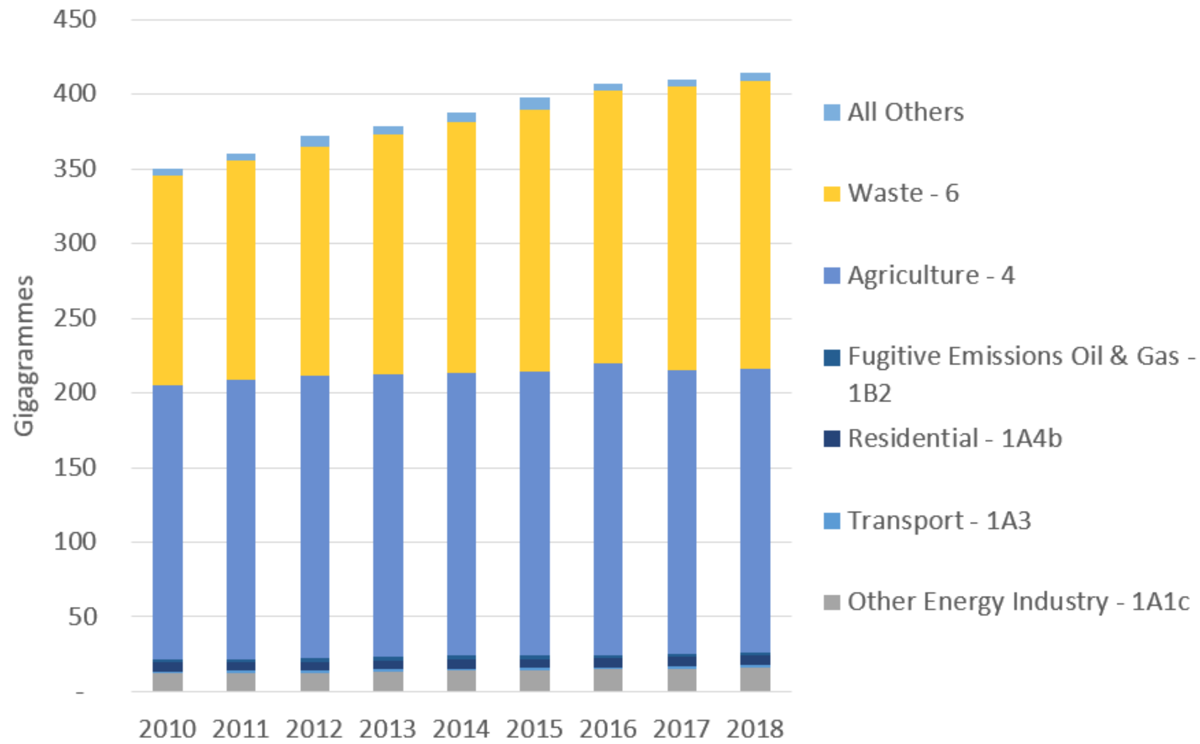

Figure 5: Methane emissions in Dominican Republic between 2010 and 2018 (units: gigagrams)

3. Short-Lived Climate Pollutant mitigation options

Having identify the main emission source sectors of short-lived climate pollutants and air pollutants as summarized in Section 2, the next step is to identify the main mitigation options that could be taken that can reduce emissions. The aim of this assessment was to evaluate the potential to reduce SLCP emissions (and air pollutants and greenhouse gases) from the implementation of relevant, nationally-appropriate mitigation actions in the Dominican Republic. To do this, the first step was to develop a baseline scenario to project how emissions were likely to change into the future (2030) without the implementation of any additional policies and measures. To develop the baseline scenario, changes in activities variables, such as fuel consumption in residential, industry and services, number of vehicles, electricity matrix etc. were taken from existing reports and statistics. The intention in this assessment was to use existing projections and assess what those future projections imply for SLCP emissions, rather than developing new projections based on new assumptions about socioeconomic development in Dominican Republic. For the energy demand sectors (industry, services, residential, agriculture etc.), the energy demand projections from 'Prospectiva de la Demanda de Energía de República Dominicana, 2010-2030' were used to project energy demand from 2019 to 2030. For electricity consumption, projections of electricity generation from 'Informe Definitivo Programa Operación de Largo Plazo, 2020-2023[2] were used to project into the future.

Table 3 summarizes the projected changes in emissions of SLCPs, air pollutants and GHGs in Dominican Republic until 2030. Compared to 2020, emissions of black carbon and methane are projected to increase 7% and 21%, respectively.

Table 3: Baseline scenario projections of SLCPs, air pollutants and greenhouse gases to 2030 (units: gigagrams)

Pollutant	2010	2015	2020	2025	2030
Carbon Dioxide	20,504	24,880	29,082	32,657	38,051
Carbon Monoxide	366	438	417	426	436
Methane	347	394	456	501	549
Non Methane Volatile Organic Compounds	115	128	130	133	136
Nitrogen Oxides	62.7	71.9	83.4	91.4	103.4
PM10	41.2	48.3	44.0	43.8	44.3
Sulphur Dioxide	117	124	73	81	122
PM2.5	34.6	40.5	36.9	36.8	37.4
Black Carbon	3.69	4.00	3.78	3.89	4.06
Organic Carbon	15.7	18.6	16.7	16.6	16.6

3.1 Mitigation Measure Evaluated

The mitigation policies and measures that were selected and evaluated in terms of their SLCP emission reduction potential were selected from existing plans, strategies, laws, and regulations that are in place in the Dominican Republic. The policies and measures identified in existing plans in Dominican Republic were not designed specifically to reduce SLCPs. However, as outlined above, SLCPs share many of the same sources as greenhouse gases and air pollutants, and therefore many existing policies and measures target sources of SLCPs, even though that was not the reason that these measures were included in plans and regulations.

Additional policies and measures were then identified that are not included in existing plans and strategies in the Dominican Republic. A large number of global and regional assessments have identified key mitigation measures, which, if implemented, would substantially reduce emissions of SLCPs, air pollutants and greenhouse gases. Therefore, the mitigation measures in these assessments were evaluated and those that were applicable to the Dominican Republic selected to be evaluated. Those selected were determined based on whether they are appropriate in the Dominican Republic, and whether they target a major SLCP emission source sector. Those measures that do not target

[2] https://www.oc.org.do/Informes/Operaci%C3%B3n-del-SENI/Planeaci%C3%B3n-del-SENI/EntryId/115843

source sectors covered by existing policies and measures were given higher priority. The list of mitigation measures evaluated is shown in Table 4.

Table 4: List of mitigation measures evaluated for mitigation potential of short-lived climate pollutants and air pollutants

Number	Source Sector	IPCC Source Category	Mitigation Measure	Target and timeline	Source of mitigation measure	Reference
1	Electricity Generation	1A1a	Increase proportion of electricity generated from renewable sources	25% of electricity will be generated from renewable sources by 2025	Law 57-07 on Incentives for the Development of Renewable Energy Sources and their Special Regimes	https://www.cne.gob.do/wp-content/uploads/2015/05/REGLAMENTO-LEY-57-07.pdf
2	Transport	1A3b	Decrease average age of vehicle fleet	By 2030, reduce average age of vehicle fleet to 10 years (from 15 years)	Economic Development Plan Compatible with Climate Change (Plan DECCC, in Spanish)	https://cambioclimatico.gob.do/download/plan-deccc-pdf/
3	Transport	1A3b	Increase proportion of vehicles using CNG	Convert 110,000 vehicles using diesel, 108,000 vehicles using gasoline, and 240,000 using LPG to CNG by 2030	Economic Development Plan Compatible with Climate Change (Plan DECCC, in Spanish)	https://cambioclimatico.gob.do/download/plan-deccc-pdf/
4	Transport	1A3b	Increase use of biofuels in transport sector	Achieve E20 mix of gasoline and B12 mix of diesel by 2030	Economic Development Plan Compatible with Climate Change (Plan DECCC, in Spanish)	https://cambioclimatico.gob.do/download/plan-deccc-pdf/
5	Transport	1A3b	Increase use of biofuels in transport sector	Achieve E50 mix of gasoline and B68 mix of diesel by 2030	Economic Development Plan Compatible with Climate Change (Plan DECCC, in Spanish)	https://cambioclimatico.gob.do/download/plan-deccc-pdf/
6	AFOLU		Decrece CO2 eq	Reduce 42,153 tons de CO2-eq per year (between 2019-2021)	Proyecto Ganadería climáticamente Inteligente	https://ganaderiayclimard.do/ganaclima/

3.2 Emission Reduction Potential

When taken as a whole, the full implementation of the mitigation measures included in Table 4 were estimated to reduce emissions of the black carbon by 6% in 2030 compared with a baseline scenario (Table 3). These mitigation measures would also be effective in reducing other greenhouse gases such as carbon dioxide, reducing CO_2 emissions by 23% in 2030 compared to a baseline scenario (and excluding CO_2 source and sinks form land use change).

To reduce black carbon emissions, the most effective mitigation measure was decreasing the average age of vehicles to 10 years (Table 5). This was assumed to be implemented in a way that increased the fraction of vehicles in the vehicle fleet meeting the Euro 6 vehicle emission standards, which include particle filters to substantial reduce BC emissions from vehicles. In order to achieve this mitigation measure, there needs to be in place an effective, regular technical review of vehicles to ensure that they continue to meet the vehicle emission standards. In addition, for diesel particle filters to be effective the sulphur content of the fuel needs to be below 50 ppm. A review of Sulphur content of fuels, the Review of NORDOM 415, focused on diesel quality standards and specifications, related to the sulfur levels of the diesel sold in the country (Premium diesel oil with 2000ppm of sulfur and regular diesel with 6500ppm of sulfur). They must be reduced in order to reduce emissions of criteria pollutants, short-lived climate pollutants and GHGs.

Another mitigation measure in the transport sector would be the modification of Law 147-00, since in article 2, paragraph VI, it allows the import of heavy vehicles up to 15 years old. Another mitigation measure in the transportation sector is the implementation of the National Electric Mobility Strategic Plan in the DR, currently this is carried out by National Institute of Traffic and Land Transportation (INTRANT, in Spanish). It consists of 4 strategic axes and their execution is scheduled for 2030. This measure has not been evaluated in this analysis as the timeframe for the assessment was 2030. Subsequent assessments that evaluate long-term mitigation strategies could take the electrification of the vehicle fleet into account in terms of how it could reduce air pollution as well as GHGs.

In the case of mitigation measures to reduce emissions from the use of firewood in residences. In this sense, some foundations, NGOs and state institutions have had projects related to artisan stoves called Lorena. Among these institutions is the Rural and Sub-Urban Electrification Unit (UERS, in Spanish), The Foundation for the Development of Azua, San Juan and Elías Piña (FUNDASEP, in Spanish), so these projects should be replicated nationwide in rural areas.

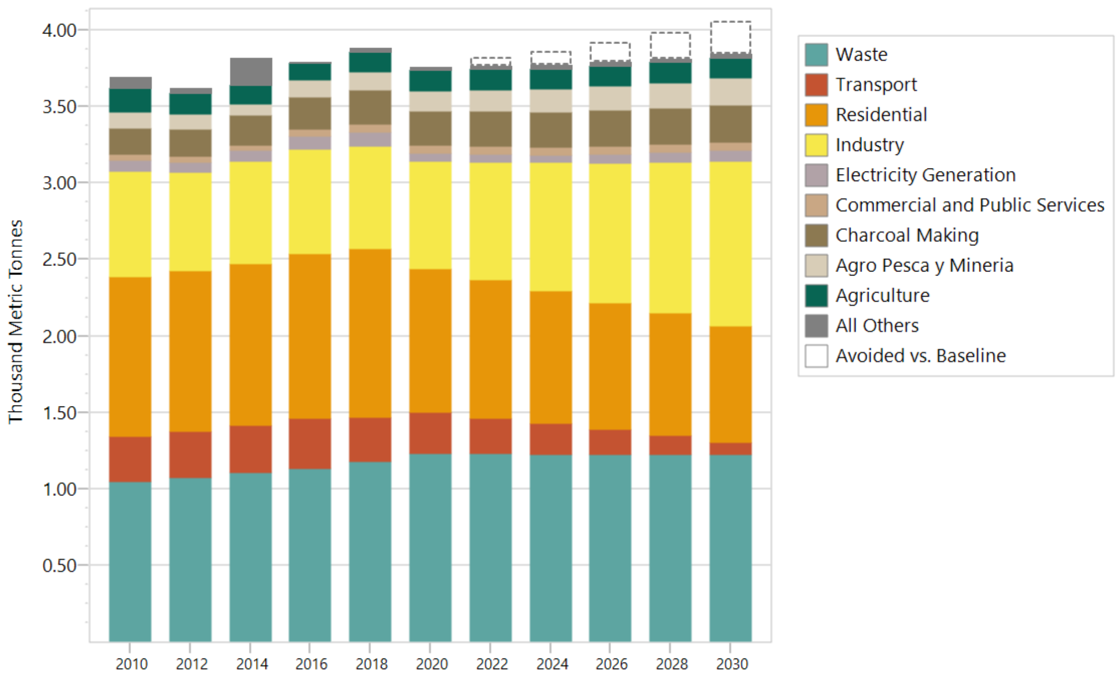

Figure 6: Reduction in black carbon emissions from implementation of all mitigation measures evaluated.

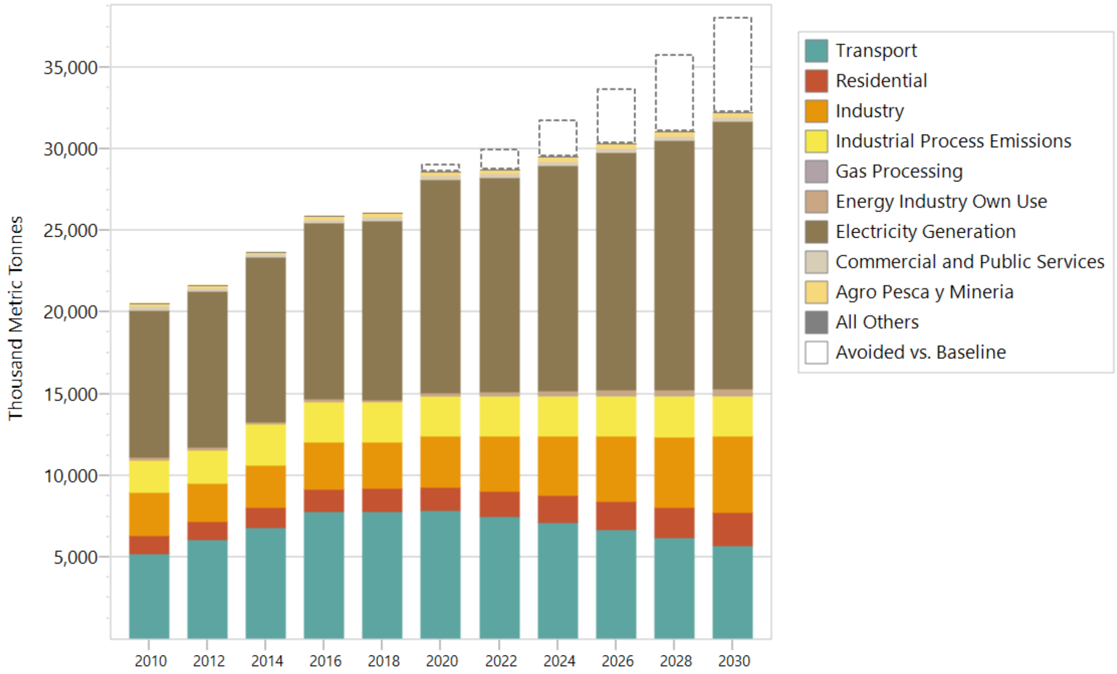

Figure 7: Reduction in carbon dioxide emissions from implementation of all mitigation measures evaluated

Table 5: Reduction in emissions of SLCPs, air pollutants and GHGs from implementation of all mitigation measures evaluated in this assessment

Scenario	BC	CH4	PM2.5	PM10	OC	SO2	NOx	NMVOC	CO	CO2
Emissions for different mitigation measures in 2030 (gigagrams)										
Baseline	4.1	549.2	37.4	44.3	16.6	122.1	103.4	135.6	436.0	38,050
1 Renewable Electricity Generation	4.1	548.8	37.4	44.2	16.6	119.9	102.6	135.0	435.8	37,132
2 Decrease average age of fleet to 10 years	3.9	549.2	37.1	44.0	16.5	122.1	91.6	133.9	410.7	38,051
3 CNG Conversion Vehicles	4.0	549.7	37.3	44.2	16.6	120.8	101.9	134.3	432.5	37,767
4 Biofuels Transport 1	4.0	549.2	37.3	44.2	16.6	122.1	104.0	135.6	436.0	36,694
5 Biofuels Transport 2	4.0	549.2	37.3	44.2	16.6	122.1	103.6	135.5	435.6	33,002
All measures	3.8	549.7	37.1	43.9	16.5	118.6	89.5	132.1	409.7	32,238
Percent reduction in emissions in 2030 compared to baseline scenario from implementing mitigation measures (% reduction)										
1 Renewable Electricity Generation	-0.1	-0.1	0.0	-0.1	0.0	-1.8	-0.8	-0.5	-0.1	-2.4

2 Decrease average age of fleet to 10 years	-4.7	0.0	-0.7	-0.6	-0.2	0.0	-11.4	-1.3	-5.8	0.0
3 CNG Conversion Vehicles	-0.7	0.1	-0.1	-0.1	0.0	-1.1	-1.5	-1.0	-0.8	-0.7
4 Biofuels Transport 1	-0.7	0.0	-0.1	-0.1	0.0	0.0	0.6	0.0	0.0	-3.6
5 Biofuels Transport 2	-1.1	0.0	-0.2	-0.1	0.0	0.0	0.2	-0.1	-0.1	-13.3
All measures	-5.3	0.1	-0.8	-0.7	-0.2	-2.9	-13.4	-2.6	-6.0	-15.3

3.3 Air Pollutant reduction benefits

In addition to reducing Dominican Republic's contribution to climate change through GHG and SLCP emission reduction, the mitigation measure evaluated in this assessment would also be effective in reducing a range of air pollutants, helping to reduce risks to human health and achieve local benefits from achieving climate change commitments. For example, nitrogen oxides are an air pollutant whose emissions are mostly from transport and electricity generation. The mitigation measures that target increasing the fraction of electricity generated from renewables and decreasing the age of the vehicle fleet will result in a combined 20% reduction NO_x emissions in 2030 compared to a baseline scenario.

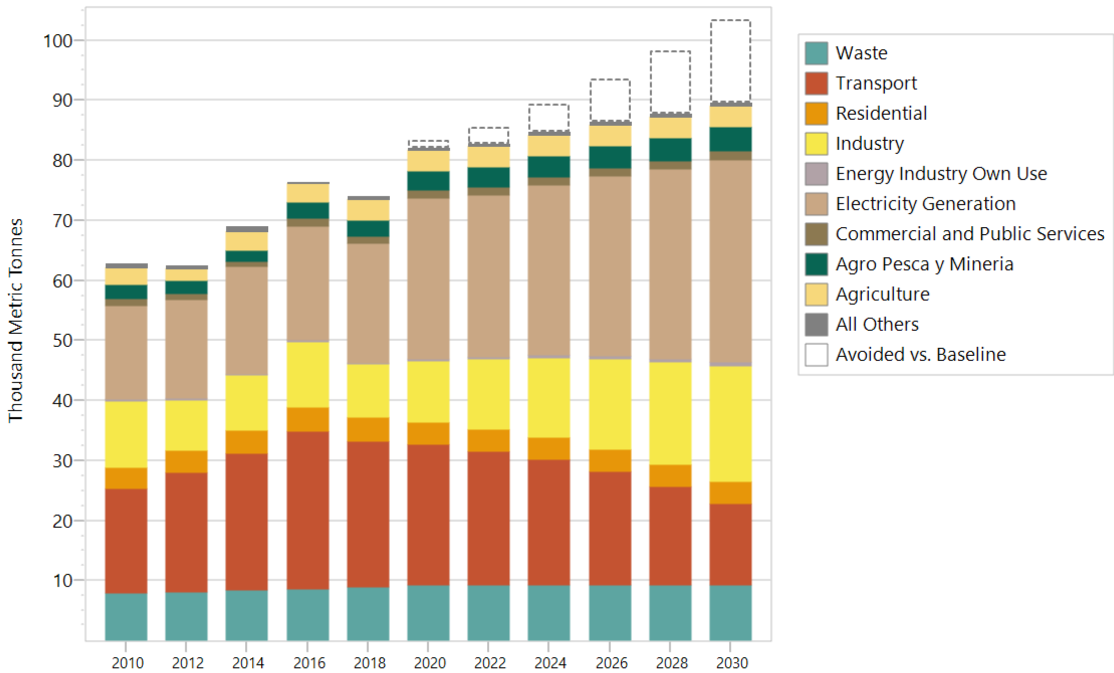

Figure 8: Reduction in nitrogen oxides (NO_x) emissions from implementation of all mitigation measures evaluated

4. Recommendations for inclusion of SLCPs in NDC revision and climate change planning in Dominican Republic

4.1 Inclusion of SLCPs in Dominican Republic's NDC revision

The assessment of SLCP mitigation actions for Dominican Republic described in Section 3, quantifies the potential to reduce SLCP, and air pollutant emissions from 5 mitigation measures included in existing plans and strategies in Dominican Republic, and X mitigation measures that are not currently included in existing plans. Overall, the full implementation of these measures could reduce black carbon emissions by 6% in 2030 compared to a baseline scenario, and methane emissions by 1%. These same actions were also shown to substantially reduce CO_2 emissions, and a range of other air pollutants. Therefore, they are relevant for consideration in the update of Dominican Republic's Nationally Determined Contribution because:

1. The inclusion of SLCPs in the update to Dominican Republic's NDC update would increase ambition to reduce all substances that contribute to warming of the atmosphere compared to the first NDC that was submitted to the UNFCCC by Dominican Republic in 2015.
2. The inclusion of actions targeting SLCPs would also reduce carbon dioxide, contributing to Dominican Republic achieving its GHG mitigation commitment submitted in their NDC.
3. Including SLCPs in Dominican Republic's NDC update will result in local benefits in Dominican Republic through improvements in air quality. SLCPs like black carbon directly impact air quality and result in negative health impacts. The actions identified to reduce SLCPs will also reduce a range of other air pollutant emissions, such as $PM_{2.5}$ and nitrogen oxides, further increasing the air quality and human health benefits from implementing Dominican Republic's climate change commitments.

Many countries have included short-lived climate pollutants in their Nationally Determined Contribution, both explicitly or implicitly, and this has been done in different ways. Different options have been summarized in an Climate and Clean Air Coalition (CCAC) report published in 2019 titled *'Opportunities for Increasing Ambition of Nationally Determined Contributions through Integrated Air Pollution and Climate Change Planning: A Practical Guidance document'*. The different options included in this document, that reflect how countries have included SLCPs in their NDC revisions are not mutually exclusive, and the most appropriate will depend on national context in Dominican Republic. This section describes the different options which could be used to include SLCPs in the NDC revision of Dominican Republic, and how the mitigation assessment described in Section 3 can be used to support each of the options.

Option 1: Setting targets for black carbon and other SLCPs

The first option for the inclusion of SLCPs in the NDC revision is the setting of specific targets to reduce SLCPs. It is important to note that some SLCPs, such as methane and hydrofluorocarbons, are greenhouse gases, and therefore reductions in methane and HFCs can be included within an overall

GHG reduction target. However, black carbon is not a greenhouse gas, and has a substantially shorter atmospheric lifetime which makes it difficult to convert into a CO_2 equivalent value. In this case it is recommended that reductions in black carbon be reported as reductions in the mass of black carbon emissions.

Black carbon reduction target: A target to reduce black carbon has been set in the NDCs of Mexico and Chile. The formulation of that target differs between the two NDCs. In Mexico, the black carbon target is a 51% reduction in black carbon emissions in 2030 compared to a baseline scenario. In contrast, in Chile, the black carbon target is 25% reductions in black carbon emissions in 2030 compared to 2016 levels (i.e. the base year). These present two options for how a black carbon emission reduction target could be formulated in the NDC revision. These are only two options, and other approaches could be formulated. For example, a black carbon reduction target could be based on a specific mass (grams) of emissions that will be reduced or could specify emission reductions for specific source sectors. Table 6 includes possible targets that could be formulated for black carbon emission reductions, based on the analysis included in Section 3.

Table 6: Possible targets to reduce black carbon based on analysis in Section 3.

	Type of target	Possible Target
1	Emission reduction vs baseline	6% reduction in black carbon emissions in 2030 compared to a baseline scenario
2	Emission reduction vs base year	X% reduction in black carbon emissions in 2030 compared to 2018 levels
3	Mass of black carbon emitted	Emit no more than X gigagrams of black carbon in 2030
4	Sectoral black carbon targets	Reduce black carbon emissions by X% in the energy sector

Targets for other SLCPs: As stated above, methane and HFCs, the other short-lived climate pollutants, are also greenhouse gases. Therefore, for methane and HFCs, the reduction in these SLCPs should first be reflected in the overall GHG emission reduction target that is defined in the updated NDC. However, to facilitate transparency, clarity, and understanding of the NDC, additional targets could be added that specify the emission reductions in methane and HFCs. Possible formulations for these targets are outlined in Table 7.

Table 7: Possible targets to reduce methane and HFCs based on analysis in Section 3.

	Type of target	Possible Target
1	Emission reduction vs baseline	X% reduction in methane/HFC emissions in 2030 compared to a baseline scenario
2	Emission reduction vs base year	X% reduction in methane/HFC emissions in 2030 compared to 2018 levels
3	Mass emitted	Emit no more than X gigagrams of methane/HFC in 2030
4	Sectoral targets	Reduce black carbon emissions by X% in the energy sector

Option 2: Include specific mitigation actions that will maximize SLCP and air pollutant emission reductions in NDC revision.

Key to reducing SLCPs and air pollutants as part of a country's climate change commitment is the implementation of actions in key SLCP emission source sectors. The mitigation measures that are most effective at reducing SLCPs have been identified in the mitigation assessment included in Section 3. Specifying the mitigation actions that will be implemented to achieve an overall climate change commitment can increase the transparency, clarity and understanding of the NDC, and ensure that those actions with the greatest SLCP and local air pollution benefits are prioritized and taken forward as the NDC moves towards implementation.

Table 5 in Section 3 includes all mitigation measures that were evaluated and highlights the effectiveness of the mitigation measures in reducing different pollutants. Table 8 below summarizes these mitigation measures and could be used to specify which mitigation measures should be included in the NDC revision.

Table 8: List of mitigation measures and their effectiveness in reducing SLCP emissions. (- not effective, ● some reduction, ●● effective, ●●● very effective)

Number	Source Sector	Mitigation Measure	Black carbon	Methane	Carbon dioxide	Other air pollutants
1	Electricity Generation	Increase proportion of electricity generated from renewable sources	●	-	●●●	●●●
2	Transport	Decrease average age of vehicle fleet	●●●	-	●	●●
3	Transport	Increase proportion of vehicles using CNG	●	-	-	●
4	Transport	Increase use of biofuels in transport sector	●	-	●●	●
5	Transport	Increase use of biofuels in transport sector	●	-	●●	●

When specifying the mitigation actions that will be included in the NDC revision, to maximize transparency and clarity, we recommend that the specific emission reductions estimated for individual mitigation measures are included. These are specified in Table 5 and can provide useful information for tracing progress on the implementation of the NDC.

4.2 Next steps

This assessment has demonstrated that in Dominican Republic the pollutants contributing to air pollution, and those that contribute to global climate change are in many cases emitted from the same sources. In particular residential wood combustion, transport, waste and agriculture are major sources of SLCPs, GHGs and air pollutants. This shows that there is an opportunity to integrate air pollution and climate change planning and reporting, to identify strategies that can simultaneously achieve both local improvements in air quality, while meeting Dominican Republic's climate change commitment. This assessment provides a first analysis of the potential for joint action on air pollution and climate change in Dominican Republic, but a sustainable system should be put in place that increases the links between air pollution and climate change planning.

The climate change planning and reporting process provides a well-established set of procedures into which SLCPs and air pollution co-benefits can be integrated to enhance the effectiveness of both climate change planning and air quality management. For climate change planning, the inclusion of SLCPs allows pollutants with an impact on global temperature increases to be incorporated into the planning, allowing the overall effect of Dominican Republic's policies on atmospheric warming to be assessed. The inclusion of air pollutants in climate change planning allows this key co-benefit of climate change strategies to be quantified and put forward as a local benefit from Dominican Republic meeting its international climate change commitments. These provide justification for the inclusion of SLCPs in the NDC of Dominican Republic outlined above.

Air quality management can also be enhanced through the inclusion of SLCPs and air pollutants in climate change planning because of the substantial overlap in the processes and analytical work needed for climate change planning and air quality management. For example, the stakeholders required to be mobilized for improving air quality are in many cases the same as those needed for climate change mitigation, because of the large overlap in the source sectors being targeted. Therefore, inter-sectoral or inter-ministerial task forces can also be a forum to discuss and engage the relevant stakeholder for air pollution abatement, alongside climate change mitigation. In addition, the greenhouse gas emission inventory process in many cases collects a large volume of the data required to also estimate emissions of air pollutants. Therefore, quantification of air pollutant and SLCP emissions within a GHG emission inventory or GHG mitigation assessment can provide an efficient way of tracking progress on air pollutant and SLCP emissions, as well as assessing how air pollution is likely to change over time, and how effective different policies, plans and measures could be in reducing them.

Specific ways in which air pollutants and SLCPs could be integrated into climate change planning processes are:

Quantify air pollutant and SLCP emissions in GHG inventory: The GHG inventory process provides an established process for the quantification of emissions, including data collection, assessment of appropriate methods, evaluation of emission factors etc. The process for developing an air pollution and SLCP emission inventory are the same as those needed to develop a GHG emission inventory, and in many cases the activity data needed to quantify the emissions is the same, and the only addition are the selection of the most appropriate emission factors for the additional pollutants being included. Default international emission inventory guidelines exist to provide guidance on how air pollutant and SLCP emissions can be integrated into a GHG emission inventory.

The Intergovernmental Panel on Climate Change (IPCC) emission inventory guidelines provide methodologies for estimating emissions of GHGs from all major source sectors. The guidelines also state that the emissions of other ‘short-lived climate forcers’ (which include SLCPs plus air pollutants that cool the climate) can also be quantified, and that the EMEP/EEA 2019 emission inventory guidebook should be used to quantify these. This therefore provides a default, internationally-recognized methodology for including air pollutants and SLCPs within a GHG emission inventory. In addition, in May 2019, the IPCC decided to expand their guidance to provide globally-relevant methodologies to quantify emissions of short-lived climate forcers in their own guidance.

The advantage of integrating air pollutant and SLCPs into the GHG emission inventory, rather than the establishment and development of a separate emission inventory process is that i) it avoids duplication of data collection and modelling efforts where the same data is being used for GHG and air pollutant emission estimates, and ii) it ensures that the outputs in terms of air pollutant and SLCP emissions are consistent with the emission estimates of GHGs.

Maintain and update integrated climate change and air pollution mitigation analyses: The analysis shown in this report assesses in an integrated way the emission levels of air pollutants, short-lived climate pollutants and greenhouse gases. This analysis could be the basis to continue to assess mitigation measures and options over time to reduce Dominican Republic’s contribution to climate change and improve air quality. In the future, air pollution and SLCP emissions can be added to the traditional GHG mitigation analyses undertaken for climate change planning by updating the number of pollutants for which emission factors were included in the analysis, and the mitigation measures that were evaluated (both climate change mitigation measures and air pollutant mitigation measures). The result would be an analysis where the air pollutant emission reductions of climate change actions, and the GHG reductions of air pollution actions can be evaluated.

By ensuring that this type of integrated climate change and air pollution analysis is used for the identification, evaluation and prioritization of climate change mitigation actions (e.g. in National Communications and biennial reports etc.) can ensure that i) actions taken to mitigate climate change do not lead to increases in air pollution, ii) to ensure that the actions taken for climate change mitigation and air pollution reductions are in line with each other and do not conflict, iii) to identify what additional actions could be taken that will maximize the reductions in both air pollution and GHGs.

Include air pollutants and SLCPs in National Communications and Biennial Reports: The climate change reporting to the UNFCCC provides the opportunity for Dominican Republic to communicate the progress that is being made on GHG emissions and implementing actions to meet its climate change commitments. The inclusion of air pollutants and SLCPs in these reports can also be an opportunity to communicate i) the actions and measures that Dominican Republic is implementing that achieve multiple benefits for air pollution and climate, ii) the emissions of air pollutants and SLCPs alongside GHGs, and the potential for simultaneous mitigation of both impacts.

Consider air pollution in development of long-term climate change mitigation strategy: In addition to the NDC commitment on emission reductions to 2030, to meet the goals of the Paris Agreement there is a need to completely decarbonize by 2050. Countries are beginning to develop long-term strategies to set out a vision for climate change mitigation plans over the long-term. Considering air pollution, as well as other sustainable development benefits within the process of developing a long-term climate change mitigation strategy can ensure that local benefits are taken into account when assessing how Dominican Republic plans to develop over the long-term.

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Annex

Technical Annex 1: Emission inventory of air pollutant, short-lived climate pollutant and greenhouse gas emissions

1. Overview

The key equation used to estimate emissions from all major sources of the pollutants listed above is the multiplication of an *activity* variable multiplied by an *emission factor* (Equation 1). The activity variable quantifies how big a particular sector or process is in a country (e.g. the number of Terajoules of fuel consumed in a particular sector, the number of tonnes of production of a particular mineral, chemical or other product). Emission factors quantify the mass of pollutant emitted per unit of activity (e.g. the kilogrammes of black carbon emitted per Terajoule of fuel consumed).

$$Emissions = \ Activity\ x\ Emission\ Factor \qquad \text{Equation 1}$$

The specific activity data, emission factors and methodologies used to quantify emissions in each source sectors are defined according to international guidelines on the quantification of GHG and air pollutant emissions. Specifically, the methodologies follow the Intergovernmental Panel on Climate Change (IPCC) 2006 emission inventory guidelines. The IPCC 2006 guidelines provide methodologies for the quantification of GHG emissions. They also recommend that for other pollutants, the EMEP/EEA air pollution emission inventory guidebook is used. These methodologies (predominantly the most simple 'Tier 1' methods) were followed to develop this inventory and are described in detail for each sector in Section 2.3.

The major sources of activity data to estimate emissions were from national data sources, including the National Net Energy Balance for fuel consumption data, and statistics on the vehicle fleet composition. For other sectors where national statistics were not available, data from international databases (e.g. UNGS Minerals Database and FAOStat) were used to capture the activity data from the major source sectors.

The major sources of emission factors for each pollutant were predominantly from IPCC 2006, and the EMEP/EEA emission inventory guidebook. In addition, for some sources emission factors were taken from the scientific literature, and are included in Section 2.3 for each pollutant for each source.

Time Period Covered

Due to the availability of activity data, the time period covered in this emission inventory begins in 2010 and ends in 2018.

Source sectors covered in the emission inventory

The emission sources covered in the inventory cover all the major sources of SLCPs and air pollutants, and greenhouse gases, with the exception of land-use and land-use change emissions. Emission sources were grouped according to the IPCC source categories. The source sectors covered are described in Table S1.

Table S1: Source sectors covered in emission inventory

Source Sector	Sub-sectors
1 - Energy	1A1a Public Electricity and Heat Production
	1A1c Manufacture of Solid Fuels and Other Energy Industries
	1A2 Manufacturing Industries and Construction
	1A3b Road transportation
	1A3c Railways
	1A4a Commercial/Institutional
	1A4b Residential
	1A4c Agriculture, Forestry, Fishing
	1A5 Other
	1B1a Fugitive emissions from coal mining
	1B2 Fugitive emissions from oil and gas
2- Industrial Processes	2A Mineral Industry
	2B Chemical Industry
	2C Metal Industry
3 – Agriculture, Forestry and Other Land-Use	3A Livestock
	3C Aggregate sources and non-CO2 emission sources on land
	3D Other
4 - Waste	4A Solid Waste Disposal on Land

2 Emission inventory methods and results by sector

2.1 Energy Sector

2.1.1 Electricity Generation – 1A1

Methodology: Emissions from electricity generation were calculated by multiplying the total fuel consumption in the power generation sector by fuel-specific emission factors for each pollutant.

Activity Data: Total consumption of bagasse, coal, diesel, heavy fuel oil, natural gas, and gasoline for electricity generation in Dominican Republic (Thousand tonnes of oil equivalent).

> **Source:** National Net Energy Balance (BNEN, in Spanish), can be downloaded from https://www.cne.gob.do/archivo/bnen-1998-al-2013-actualizado-23-abril-2015-unidades-propias/.

Emission Factors: Emission factors were included for 11 pollutants described in Section 2.1. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from electricity generation are shown in Tables S2-S10.

Table S2: Emissions of carbon dioxide from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Diesel	1,347	1,720	1,606	1,141	1,238	1,433	1,396	920	1,070
Gasoline	49	49	51	50	47	47	47	46	46
Heavy Fuel Oil	4,051	3,971	3,618	3,679	4,169	4,814	4,964	4,108	5,131
Natural Gas	1,610	1,697	1,950	2,020	1,986	2,012	1,880	2,198	2,170
Other Bituminous Coal and Anthracite	2,048	2,194	2,400	2,350	2,727	2,572	2,618	2,757	2,616

Table S3: Emissions of methane from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bagasse	0.03	0.02	0.03	0.02	0.02	0.02	0.03	0.07	0.10
Diesel	0.05	0.07	0.07	0.05	0.05	0.06	0.06	0.04	0.04
Heavy Fuel Oil	0.16	0.15	0.14	0.14	0.16	0.19	0.19	0.16	0.20
Natural Gas	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.04	0.04
Other Bituminous Coal and Anthracite	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.03

Table S4: Emissions of carbon monoxide from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bagasse	0.08	0.07	0.08	0.07	0.07	0.07	0.08	0.22	0.29
Diesel	0.29	0.38	0.35	0.25	0.27	0.31	0.31	0.20	0.23
Gasoline	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Heavy Fuel Oil	0.79	0.77	0.71	0.72	0.81	0.94	0.97	0.80	1.00
Natural Gas	1.12	1.18	1.36	1.40	1.38	1.40	1.31	1.53	1.51
Other Bituminous Coal and Anthracite	0.19	0.20	0.22	0.22	0.25	0.24	0.24	0.25	0.24
Other Primary Biomass	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table S5: Emissions of nitrogen dioxide from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bagasse	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.20	0.26
Diesel	1.18	1.51	1.41	1.00	1.09	1.26	1.22	0.81	0.94
Gasoline	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Heavy Fuel Oil	7.43	7.29	6.64	6.75	7.65	8.83	9.11	7.54	9.41
Natural Gas	2.55	2.69	3.09	3.21	3.15	3.19	2.98	3.49	3.44
Other Bituminous Coal and Anthracite	4.52	4.85	5.30	5.19	6.02	5.68	5.78	6.09	5.78
Other Primary Biomass	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table S6: Emissions of PM2.5 from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	20187

Bagasse	0.11	0.11	0.12	0.11	0.11	0.11	0.12	0.32	0.43
Diesel	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01
Gasoline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Fuel Oil	1.01	0.99	0.90	0.92	1.04	1.20	1.24	1.02	1.28
Natural Gas	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Other Bituminous Coal and Anthracite	0.07	0.08	0.09	0.08	0.10	0.09	0.09	0.10	0.09
Other Primary Biomass	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Table S7: Emissions of volatile organic compounds from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	20187
Bagasse	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Diesel	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01
Heavy Fuel Oil	0.12	0.12	0.11	0.11	0.12	0.14	0.15	0.12	0.15
Natural Gas	0.07	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10
Other Bituminous Coal and Anthracite	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.03

Table S8: Emissions of black carbon from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	20187
Bagasse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Diesel	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00
Heavy Fuel Oil	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.07
Other Bituminous Coal and Anthracite	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table S9: Emissions of organic carbon from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	20187
Bagasse	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.04	0.06
Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Fuel Oil	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Natural Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table S10: Emissions of ammonia from electricity generation in gigagrams

Fuel	2010	2011	2012	2013	2014	2015	2016	2017	20187
Bagasse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel	0.04	0.05	0.05	0.04	0.04	0.05	0.04	0.03	0.03
Heavy Fuel Oil	0.13	0.13	0.12	0.12	0.14	0.16	0.16	0.13	0.17
Natural Gas	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05

2.1.2 Industry – 1A2

Methodology: Emissions from industrial energy consumption were calculated by multiplying the total fuel consumption in the industry sector, disaggregated into different industrial activities, by fuel-specific emission factors for each pollutant. Industrial fuel consumption was split into the following sub-sectors, Cement and ceramics, Construction, Sugar Mills, Paper, Chemical and Plastics, Food, Tabacco, Textiles, Zona Franca and Other Industries.

Activity Data: Total consumption of different fuels for industrial energy use in Dominican Republic (Thousand tonnes of oil equivalent).

> **Source:** National Net Energy Balance (BNEN, in Spanish), can be downloaded from https://www.cne.gob.do/archivo/bnen-1998-al-2013-actualizado-23-abril-2015-unidades-propias/.

Emission Factors: Emission factors were included for 11 pollutants described in Section 2.1. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from industry fuel consumption are shown in Tables S11-S18.

Table S11: Emissions of carbon dioxide from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Coke Oven Coke	1,218.81	1,250.54	1,209.90	1,218.42	1,447.11	1,727.28	1,419.25	1,319.23	1,763.32
Cement and Ceramics: Gas Diesel Oil	45.72	37.72	40.91	42.48	34.75	48.23	52.76	47.87	51.57
Cement and Ceramics: Heavy Fuel Oil	301.23	67.31	128.20	391.27	173.83	10.08	230.64	322.96	43.09
Cement and Ceramics: LPG Liquefied Petroleum Gas	16.47	16.06	15.33	16.44	17.13	18.07	19.97	18.69	19.32
Cement and Ceramics: Natural Gas	7.99	23.80	29.74	24.85	24.92	24.83	25.15	24.16	24.99
Cement and Ceramics: Other Bituminous Coal and Anthracite	237.96	232.76	240.26	256.36	291.83	300.50	299.35	305.59	316.01
Construction others: LPG Liquefied Petroleum Gas	36.52	32.92	32.49	33.28	35.43	38.34	39.56	38.56	38.41
Construction others: Motor Gasoline	62.73	63.73	64.55	66.12	68.88	71.08	73.34	74.97	77.31
Sugar Mills: Gas Diesel Oil	72.86	61.45	64.90	66.83	55.59	75.89	82.96	77.08	84.48
Sugar Mills: Natural Gas	12.02	38.19	48.37	40.47	39.13	39.18	39.16	37.81	40.07
Paper and Printing: Heavy Fuel Oil	92.71	20.55	39.42	120.50	53.43	3.22	71.12	99.68	13.54
Paper e Printing: LPG Liquefied Petroleum Gas	4.23	3.84	3.77	3.84	4.24	4.64	4.85	4.72	4.85
Chemicals and Plastics: Gas Diesel Oil	77.35	65.51	68.85	70.83	59.28	80.92	88.68	81.79	89.72

Chemicals and Plastics: Heavy Fuel Oil	8.32	1.75	3.52	10.57	4.72	0.31	6.42	8.88	1.05
Chemicals and Plastics: LPG Liquefied Petroleum Gas	0.44	0.24	0.26	0.27	0.45	0.26	0.28	0.28	0.29
Chemicals and Plastics: Natural Gas	12.65	40.52	51.66	43.33	41.66	41.91	41.90	40.62	42.99
Food Industry Remains: Gas Diesel Oil	66.38	56.08	59.18	60.26	50.48	69.20	75.98	69.73	76.56
Food Industry Remains: Heavy Fuel Oil	217.69	48.42	92.72	283.67	125.90	7.68	166.99	233.98	31.84
Food Industry Remains: LPG Liquefied Petroleum Gas	60.17	55.55	54.23	55.65	60.19	66.23	69.42	67.54	69.42
Food Industry Remains: Motor Gasoline	2.67	3.21	3.01	3.17	3.54	3.44	3.70	3.26	3.98
Food Industry Remains: Natural Gas	10.81	34.66	44.32	37.27	35.83	35.70	35.95	34.97	36.49
Food Industry Remains: Non_specified petroleum products	16.42	15.45	13.51	15.28	15.78	15.92	16.62	17.43	18.43
Other Industries: Gas Diesel Oil	14.66	12.48	13.07	13.43	11.26	15.37	16.85	15.46	16.99
Other Industries: LPG Liquefied Petroleum Gas	17.13	15.75	15.34	15.81	17.08	18.76	19.56	19.26	19.63
Other Industries: Motor Gasoline	0.20	0.21	0.22	0.23	0.20	0.23	0.24	0.24	0.25
Other Industries: Natural Gas	2.35	7.68	9.80	8.23	7.87	7.97	8.02	7.67	8.17
Tobacco: Gas Diesel Oil	0.61	0.51	0.54	0.56	0.47	0.63	0.69	0.64	0.70
Tobacco: Heavy Fuel Oil	2.03	0.45	0.86	2.64	1.17	0.07	1.56	2.18	0.29
Tobacco: LPG Liquefied Petroleum Gas	0.32	0.30	0.29	0.30	0.32	0.35	0.37	0.36	0.37
Tobacco: Natural Gas	0.10	0.32	0.40	0.34	0.32	0.33	0.33	0.32	0.34
Textiles and Leather: Gas Diesel Oil	4.43	3.73	3.98	4.06	3.37	4.64	5.11	4.68	5.17
Textiles and Leather: Heavy Fuel Oil	59.86	13.27	25.50	77.87	34.52	2.08	45.91	64.33	8.78
Textiles and Leather: Natural Gas	0.72	2.35	2.95	2.48	2.37	2.42	2.43	2.36	2.45
Free Trade Zone: Gas Diesel Oil	117.33	100.06	108.17	108.94	88.77	119.19	127.76	119.78	134.06
Free Trade Zone: Heavy Fuel Oil	11.33	2.74	5.11	14.93	6.47	0.48	8.56	12.36	1.62
Free Trade Zone: LPG Liquefied Petroleum Gas	21.56	19.72	19.17	19.73	21.45	23.42	24.63	23.92	24.68
Free Trade Zone: Natural Gas	19.16	61.86	81.15	66.43	62.52	61.78	60.59	59.33	64.27

Table S12: Emissions of methane from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Coke Oven Coke	0.11	0.12	0.11	0.11	0.14	0.16	0.13	0.12	0.16

Cement and Ceramics: Heavy Fuel Oil	0.01	0.00	0.00	0.02	0.01	0.00	0.01	0.01	0.00
Cement and Ceramics: Other Bituminous Coal and Anthracite	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Sugar Mills: Bagasse	0.33	0.32	0.35	0.33	0.34	0.29	0.32	0.36	0.34
Food Industry Remains: Heavy Fuel Oil	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00

Table S13: Emissions of carbon monoxide from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Coke Oven Coke	10.60	10.88	10.53	10.60	12.59	15.03	12.35	11.48	15.34
Cement and Ceramics: Gas Diesel Oil	0.04	0.03	0.04	0.04	0.03	0.04	0.05	0.04	0.05
Cement and Ceramics: Heavy Fuel Oil	0.26	0.06	0.11	0.33	0.15	0.01	0.20	0.28	0.04
Cement and Ceramics: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cement and Ceramics: Other Bituminous Coal and Anthracite	2.34	2.29	2.36	2.52	2.87	2.96	2.95	3.01	3.11
Construction others: LPG Liquefied Petroleum Gas	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Construction others: Motor Gasoline	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07
Sugar Mills: Bagasse	6.30	5.99	6.59	6.18	6.48	5.43	6.16	6.86	6.44
Sugar Mills: Gas Diesel Oil	0.06	0.05	0.06	0.06	0.05	0.07	0.07	0.07	0.08
Sugar Mills: Natural Gas	0.01	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02
Paper and Printing: Heavy Fuel Oil	0.08	0.02	0.03	0.10	0.05	0.00	0.06	0.08	0.01
Chemicals and Plastics: Gas Diesel Oil	0.07	0.06	0.06	0.06	0.05	0.07	0.08	0.07	0.08
Chemicals and Plastics: Heavy Fuel Oil	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00
Chemicals and Plastics: Natural Gas	0.01	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02
Food Industry Remains: Gas Diesel Oil	0.06	0.05	0.05	0.05	0.04	0.06	0.07	0.06	0.07
Food Industry Remains: Heavy Fuel Oil	0.19	0.04	0.08	0.24	0.11	0.01	0.14	0.20	0.03
Food Industry Remains: LPG Liquefied Petroleum Gas	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Food Industry Remains: Natural Gas	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Food Industry Remains: Non_specified petroleum products	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Other Industries: Gas Diesel Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02
Other Industries: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Textiles and Leather: Heavy Fuel Oil	0.05	0.01	0.02	0.07	0.03	0.00	0.04	0.05	0.01
Free Trade Zone: Gas Diesel Oil	0.10	0.09	0.10	0.10	0.08	0.11	0.11	0.11	0.12
Free Trade Zone: Heavy Fuel Oil	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00

Free Trade Zone: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Free Trade Zone: Natural Gas	0.01	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03

Table S14: Emissions of nitrogen dioxide from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Coke Oven Coke	1.97	2.02	1.96	1.97	2.34	2.79	2.29	2.13	2.85
Cement and Ceramics: Gas Diesel Oil	0.32	0.26	0.28	0.29	0.24	0.33	0.37	0.33	0.36
Cement and Ceramics: Heavy Fuel Oil	2.00	0.45	0.85	2.59	1.15	0.07	1.53	2.14	0.29
Cement and Ceramics: LPG Liquefied Petroleum Gas	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Cement and Ceramics: Natural Gas	0.01	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03
Cement and Ceramics: Other Bituminous Coal and Anthracite	0.44	0.43	0.44	0.47	0.53	0.55	0.55	0.56	0.58
Construction others: LPG Liquefied Petroleum Gas	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05
Construction others: Motor Gasoline	0.46	0.47	0.48	0.49	0.51	0.53	0.54	0.55	0.57
Sugar Mills: Bagasse	1.01	0.96	1.05	0.99	1.03	0.87	0.98	1.09	1.03
Sugar Mills: Gas Diesel Oil	0.50	0.43	0.45	0.46	0.38	0.53	0.57	0.53	0.58
Sugar Mills: Natural Gas	0.02	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Paper and Printing: Heavy Fuel Oil	0.61	0.14	0.26	0.80	0.35	0.02	0.47	0.66	0.09
Chemicals and Plastics: Gas Diesel Oil	0.54	0.45	0.48	0.49	0.41	0.56	0.61	0.57	0.62
Chemicals and Plastics: Heavy Fuel Oil	0.06	0.01	0.02	0.07	0.03	0.00	0.04	0.06	0.01
Chemicals and Plastics: Natural Gas	0.02	0.05	0.07	0.06	0.05	0.06	0.06	0.05	0.06
Food Industry Remains: Gas Diesel Oil	0.46	0.39	0.41	0.42	0.35	0.48	0.53	0.48	0.53
Food Industry Remains: Heavy Fuel Oil	1.44	0.32	0.61	1.88	0.83	0.05	1.11	1.55	0.21
Food Industry Remains: LPG Liquefied Petroleum Gas	0.07	0.07	0.06	0.07	0.07	0.08	0.08	0.08	0.08
Food Industry Remains: Motor Gasoline	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.03
Food Industry Remains: Natural Gas	0.01	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Food Industry Remains: Non_specified petroleum products	0.11	0.11	0.09	0.11	0.11	0.11	0.12	0.12	0.13
Other Industries: Gas Diesel Oil	0.10	0.09	0.09	0.09	0.08	0.11	0.12	0.11	0.12
Other Industries: LPG Liquefied Petroleum Gas	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Tabaco: Heavy Fuel Oil	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.01	0.00
Textiles and Leather: Gas Diesel Oil	0.03	0.03	0.03	0.03	0.02	0.03	0.04	0.03	0.04
Textiles and Leather: Heavy Fuel Oil	0.40	0.09	0.17	0.52	0.23	0.01	0.30	0.43	0.06
Free Trade Zone: Gas Diesel Oil	0.81	0.69	0.75	0.75	0.61	0.83	0.88	0.83	0.93
Free Trade Zone: Heavy Fuel Oil	0.08	0.02	0.03	0.10	0.04	0.00	0.06	0.08	0.01

Free Trade Zone: LPG Liquefied Petroleum Gas	0.03	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03
Free Trade Zone: Natural Gas	0.03	0.08	0.11	0.09	0.08	0.08	0.08	0.08	0.08

Table S15: Emissions of PM2.5 from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Coke Oven Coke	1.23	1.26	1.22	1.23	1.46	1.74	1.43	1.33	1.78
Cement and Ceramics: Gas Diesel Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cement and Ceramics: Heavy Fuel Oil	0.08	0.02	0.03	0.10	0.04	0.00	0.06	0.08	0.01
Cement and Ceramics: Other Bituminous Coal and Anthracite	0.27	0.27	0.27	0.29	0.33	0.34	0.34	0.35	0.36
Construction others: Motor Gasoline	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Sugar Mills: Bagasse	1.55	1.47	1.62	1.52	1.59	1.33	1.51	1.68	1.58
Sugar Mills: Gas Diesel Oil	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Paper and Printing: Heavy Fuel Oil	0.02	0.01	0.01	0.03	0.01	0.00	0.02	0.03	0.00
Chemicals and Plastics: Gas Diesel Oil	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Food Industry Remains: Gas Diesel Oil	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02
Food Industry Remains: Heavy Fuel Oil	0.06	0.01	0.02	0.07	0.03	0.00	0.04	0.06	0.01
Textiles and Leather: Heavy Fuel Oil	0.02	0.00	0.01	0.02	0.01	0.00	0.01	0.02	0.00
Free Trade Zone: Gas Diesel Oil	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.04

Table S16: Emissions of volatile organic compounds from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Coke Oven Coke	1.01	1.04	1.00	1.01	1.20	1.43	1.18	1.09	1.46
Cement and Ceramics: Gas Diesel Oil	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Cement and Ceramics: Heavy Fuel Oil	0.10	0.02	0.04	0.13	0.06	0.00	0.07	0.10	0.01
Cement and Ceramics: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cement and Ceramics: Other Bituminous Coal and Anthracite	0.22	0.22	0.23	0.24	0.27	0.28	0.28	0.29	0.30
Construction others: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Construction others: Motor Gasoline	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Sugar Mills: Bagasse	3.32	3.15	3.47	3.25	3.41	2.86	3.24	3.61	3.39
Sugar Mills: Gas Diesel Oil	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Paper and Printing: Heavy Fuel Oil	0.03	0.01	0.01	0.04	0.02	0.00	0.02	0.03	0.00
Chemicals and Plastics: Gas Diesel Oil	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Chemicals and Plastics: Natural Gas	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Food Industry Remains: Gas Diesel Oil	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.03
Food Industry Remains: Heavy Fuel Oil	0.07	0.02	0.03	0.09	0.04	0.00	0.05	0.08	0.01
Food Industry Remains: LPG Liquefied Petroleum Gas	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.03
Food Industry Remains: Non_specified petroleum products	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01

Other Industries: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Textiles and Leather: Heavy Fuel Oil	0.02	0.00	0.01	0.03	0.01	0.00	0.01	0.02	0.00
Free Trade Zone: Gas Diesel Oil	0.04	0.03	0.04	0.04	0.03	0.04	0.04	0.04	0.05
Free Trade Zone: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Free Trade Zone: Natural Gas	0.01	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03

Table S17: Emissions of black carbon from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Coke Oven Coke	0.08	0.08	0.08	0.08	0.09	0.11	0.09	0.09	0.11
Cement and Ceramics: Gas Diesel Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cement and Ceramics: Heavy Fuel Oil	0.04	0.01	0.02	0.06	0.03	0.00	0.03	0.05	0.01
Cement and Ceramics: Other Bituminous Coal and Anthracite	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Construction others: Motor Gasoline	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sugar Mills: Bagasse	0.43	0.41	0.45	0.43	0.45	0.37	0.42	0.47	0.44
Sugar Mills: Gas Diesel Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Paper and Printing: Heavy Fuel Oil	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.01	0.00
Chemicals and Plastics: Gas Diesel Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Food Industry Remains: Gas Diesel Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Food Industry Remains: Heavy Fuel Oil	0.03	0.01	0.01	0.04	0.02	0.00	0.02	0.03	0.00
Textiles and Leather: Heavy Fuel Oil	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00
Free Trade Zone: Gas Diesel Oil	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02

Table S18: Emissions of organic carbon from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Coke Oven Coke	0.13	0.13	0.13	0.13	0.15	0.18	0.15	0.14	0.18
Cement and Ceramics: Heavy Fuel Oil	0.02	0.00	0.01	0.02	0.01	0.00	0.01	0.02	0.00
Cement and Ceramics: Other Bituminous Coal and Anthracite	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
Sugar Mills: Bagasse	0.80	0.76	0.83	0.78	0.82	0.69	0.78	0.87	0.81
Paper and Printing: Heavy Fuel Oil	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Food Industry Remains: Heavy Fuel Oil	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.01	0.00
Free Trade Zone: Gas Diesel Oil	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01

Table S19: Emissions of ammonia from industry in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cement and Ceramics: Heavy Fuel Oil	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
Food Industry Remains: Heavy Fuel Oil	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00

2.3.1.3 Transport – 1A3

Methodology: Emissions from the transport sector were disaggregated between different transport modes, including road transport and domestic aviation. Due to a lack of data, emissions from other transport sources, such as domestic shipping, were not estimated in the emission inventory.

Domestic Aviation: Emissions for domestic aviation were calculated by multiplying the total fuel consumption (Avtur) by fuel-specific emission factors for each pollutant. The total fuel consumption was taken from the National Net Energy Balance.

Road Transport: For air pollutants emissions for road transport were estimated applying the Tier 2 methodology outlined in the EMEP/EEA (2019) Emission inventory guidebook. Emissions were estimated by multiplying the annual distance travelled by pollutant specific emission factors, as shown below.

$$Emissions = Annual\ Distance\ Travelled\ (km\ y^{-1})\ x\ Emission\ Factor\ (g\ km^{-1})$$

The annual distance travelled and emission factors were specified separately for different types of vehicles, different fuels, and different vehicle emission standards. The emission factors were default emission factors described in EMEP/EEA (2019).

Number of vehicles: The different vehicle types included in the inventory were Cars*, Jeeps, Buses, Carga and Motorcycle,* for consistency with the vehicle types used in previous surveys of the vehicle fleet in Dominican Republic. The number of vehicles in each category was taken from surveys of the vehicle fleet in Dominican Republic for 2010 and 2011, shown in Table S19. To estimate the number of vehicles in each category in more recent years (2012-2018), the annual percentage growth rate of vehicles between 2010 and 2011 was applied.

Table S19: Number of vehicles in Dominican Republic of different types in 2010 and 2011

Types	2010	2011
Cars	662,633	678,732
Buses	73,862	76,300
Jeeps	254,044	274,810
Trucks	345,302	355,337
Motorcycles	1,409,975	1,481,255

Proportion of vehicles using different fuels: To estimate the percentage of vehicles in each category that use different types of fuel, the total energy consumption of each type of fuel, in each vehicle category was divided by the average per km fuel efficiency of each vehicle type consuming each type of fuel. The total fuel consumption of vehicles in each category was taken from data from the Economic and Tax Studies Department of the General Directorate of Internal Taxes (DGII, in Spanish). The average fuel efficiency of vehicles of each type consuming different types of fuel were default values taken from EMEP/EEA (2019).

Table S20: Proportion of vehicles estimated to use different types of fuels in Dominican Republic in 2010.

Vehicle type	NG	LPG	GM+AV	Avtur	Go	BD	EE
Cars	0.1	39.1	51.5	0.0	9.2	0.1	0.0
Jeeps	0.0	2.3	35.6	0.0	61.6	0.5	0.0
Buses	0.0	8.0	24.5	0.0	67.0	0.5	0.0
Motorcycles	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Trucks	0.0	14.3	35.0	0.0	50.3	0.4	0.0

Proportion of vehicles meeting different vehicle emission standards: The proportion of vehicles of each type that meet different vehicle emission standards (classified as Uncontrolled, Euro I, Euro II, Euro III, Euro IV, Euro V, and Euro VI) were classified according to the year of manufacture of the vehicles. The year of manufacture of vehicles of different types were taken from data provided by the Economic and Tax Studies Department of the General Directorate of Internal Taxes (DGII, in Spanish), shown below. The Euro standard for each year of manufacture was based on the years that each Euro standard was introduced, https://dieselnet.com/standards/eu/ld.php. Specifically, vehicle manufactured between 2003 and 2005 were assigned as Euro 3, 2005 and 2009 as Euro 4, 2010 and 2015 as Euro 5, and after 2015 as Euro 6. For the years after 2010, the additional vehicles added compared to the previous year were all assigned the Euro emission standard in place in that year. This does not take into account retirement of old vehicles, and their replacement with newer vehicles.

Table 21: Percentage of vehicles manufactured in each year in the vehicle fleet in 2010 in Dominican Republic.

Production Year	Cars	Buses	Jeeps	Trucks	Motorcycles
2010	0.4	4.2	3.1	1.2	3.6
2009	0.4	4.4	3.0	1.5	2.8
2008	1.1	8.6	9.6	2.7	6.1
2007	1.7	9.5	10.7	3.9	8.2
2006	2.2	11.7	11.3	3.7	10.1
2005	2.5	13.1	12.3	3.1	4.9
2004	1.6	10.5	4.3	1.4	1.4
2003	90.1	38.0	45.6	82.4	63.0

Source: Economic and Tax Studies Department of the General Directorate of Internal Taxes (DGII, in Spanish)

Average Distance Travelled: The average distance travelled for one vehicle in each vehicle category was derived by estimating the total number of kms travelled by vehicles in that category, divided by the total number of vehicles in that category:

$$Average\ distance\ travelled = \frac{Total\ distance\ travelled\ (km)}{Total\ number\ of\ vehicles} Total\ number\ of\ vehicles$$

The total distance travelled for each vehicle type was calculated based on the total fuel consumption (in units of toe) for each vehicle type, based on data from Economic and Tax Studies Department of the General Directorate of Internal Taxes (DGII, in Spanish). The total fuel consumption was divided by default fuel efficiency (toe/km) values, provided by EMEP/EEA (2019) for each vehicle category and fuel.

Table S22: Estimates of average distance travelled by a vehicle in each category, based on total fuel consumption and fuel efficiency estimates.

Vehicle type	km/vehicle
Cars	17636
Jeeps	13122
Buses	9397
Motorcycles	2841
Trucks	10446

Results: The total emissions from the transport sector are shown in Tables S23-S31

Table S23: Emissions of carbon dioxide from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Other or Non Specified: LPG Liquefied Petroleum Gas	1,038.26	1,038.26	1,038.26	1,038.26	1,038.26	1,038.26	1,038.26	1,038.26	1,038.26
Road: Buses: Diesel	452.98	467.93	479.30	490.95	502.87	515.09	527.61	540.43	553.55
Road: Buses: Gasoline	36.94	38.16	39.09	40.04	41.01	42.01	43.03	44.07	45.14
Road: Buses: LPG	9.92	10.25	10.50	10.75	11.01	11.28	11.56	11.84	12.12
Road: Cars: CNG	1.78	1.82	1.87	1.91	1.96	2.00	2.05	2.10	2.15
Road: Cars: Diesel	191.91	196.57	201.35	206.24	211.25	216.39	221.64	227.03	232.54
Road: Cars: Gasoline	1,233.14	1,263.10	1,293.78	1,325.22	1,357.41	1,390.39	1,424.17	1,458.77	1,494.21
Road: Cars: LPG	777.47	796.36	815.70	835.52	855.82	876.61	897.91	919.73	942.07
Road: Truck: Diesel	902.93	929.17	951.75	974.87	998.56	1,022.82	1,047.67	1,073.12	1,099.19
Road: Truck: Gasoline	277.50	285.56	292.50	299.61	306.89	314.34	321.98	329.80	337.82
Road: Truck: LPG	238.67	245.61	251.57	257.69	263.95	270.36	276.93	283.66	290.55

Road: Jeeps: Diesel	527.42	570.53	584.39	598.59	613.13	628.03	643.28	658.91	674.92
Road: Jeeps: Gasoline	261.51	282.89	289.76	296.80	304.01	311.40	318.96	326.71	334.65
Road: Jeeps: LPG	13.73	14.85	15.22	15.59	15.96	16.35	16.75	17.16	17.57
Road: Motorcycle: Four Stroke	447.55	470.18	481.60	493.30	505.29	517.56	530.14	543.02	556.21

Table 24: Emissions of methane from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Other or Non Specified: All: LPG Liquefied Petroleum Gas	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Road: Buses: Diesel	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Road: Buses: LPG	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Cars: Diesel	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Cars: Gasoline	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08
Road: Cars: LPG	0.76	0.78	0.80	0.82	0.84	0.86	0.88	0.90	0.93
Road: Truck: Diesel	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06
Road: Truck: Gasoline	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Road: Truck: LPG	0.23	0.24	0.25	0.25	0.26	0.27	0.27	0.28	0.29
Road: Jeeps: Diesel	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Road: Jeeps: Gasoline	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Road: Jeeps: LPG	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Road: Motorcycle: Four Stroke	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Table 25: Emissions of carbon monoxide from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Other or Non Specified: All: LPG Liquefied Petroleum Gas	40.69	40.69	40.69	40.69	40.69	40.69	40.69	40.69	40.69
Road: Buses: Diesel	0.81	0.81	0.82	0.82	0.82	0.82	0.83	0.83	0.83
Road: Buses: Gasoline	0.66	0.67	0.67	0.68	0.68	0.69	0.70	0.70	0.71
Road: Buses: LPG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Road: Cars: CNG	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Cars: Diesel	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11
Road: Cars: Gasoline	10.35	10.44	10.53	10.63	10.73	10.83	10.92	11.03	11.15
Road: Cars: LPG	7.73	7.80	7.87	7.94	8.02	8.09	8.17	8.25	8.34
Road: Truck: Diesel	1.55	1.55	1.56	1.56	1.56	1.57	1.57	1.57	1.58
Road: Truck: Gasoline	5.94	5.99	6.03	6.07	6.12	6.16	6.21	6.25	6.30
Road: Truck: LPG	0.52	0.53	0.54	0.56	0.57	0.58	0.60	0.61	0.63
Road: Jeeps: Diesel	0.90	0.91	0.91	0.92	0.92	0.92	0.93	0.93	0.94
Road: Jeeps: Gasoline	4.69	4.82	4.86	4.91	4.95	4.99	5.04	5.08	5.13
Road: Jeeps: LPG	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Road: Motorcycle: Four Stroke	25.28	25.90	26.21	26.53	26.85	27.18	27.52	27.87	28.23

Table 26: Emissions of nitrogen dioxide from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Other or Non Specified: All: LPG Liquefied Petroleum Gas	11.93	11.93	11.93	11.93	11.93	11.93	11.93	11.93	11.93
Road: Buses: Diesel	3.68	3.73	3.77	3.80	3.84	3.88	3.89	3.90	3.91
Road: Buses: Gasoline	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Road: Cars: Diesel	0.82	0.84	0.85	0.87	0.88	0.90	0.91	0.93	0.94
Road: Cars: Gasoline	0.57	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64
Road: Cars: LPG	0.40	0.40	0.41	0.42	0.42	0.43	0.44	0.45	0.45
Road: Truck: Diesel	7.41	7.49	7.56	7.63	7.70	7.77	7.79	7.80	7.82
Road: Truck: Gasoline	0.15	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17
Road: Truck: LPG	1.34	1.38	1.41	1.45	1.48	1.52	1.56	1.59	1.63
Road: Jeeps: Diesel	1.96	2.15	2.22	2.28	2.34	2.41	2.47	2.53	2.59
Road: Jeeps: Gasoline	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.15
Road: Motorcycle: Four Stroke	1.17	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.36

Table 27: Emissions of PM2.5 from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Other or Non Specified: All: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Buses: Diesel	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Road: Cars: Diesel	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Road: Cars: Gasoline	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Cars: LPG	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Truck: Diesel	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15
Road: Jeeps: Diesel	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Road: Motorcycle: Four Stroke	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Table 28: Emissions of volatile organic compounds from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Other or Non Specified: All: LPG Liquefied Petroleum Gas	8.92	8.92	8.92	8.92	8.92	8.92	8.92	8.92	8.92
Road: Buses: Diesel	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Road: Buses: Gasoline	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Road: Buses: LPG	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Road: Cars: Diesel	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Road: Cars: Gasoline	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77
Road: Cars: LPG	0.54	0.55	0.56	0.57	0.59	0.60	0.61	0.62	0.64
Road: Truck: Diesel	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Road: Truck: Gasoline	0.23	0.23	0.24	0.24	0.24	0.25	0.25	0.25	0.26
Road: Truck: LPG	0.36	0.37	0.38	0.39	0.40	0.41	0.42	0.43	0.44
Road: Jeeps: Diesel	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17
Road: Jeeps: Gasoline	0.20	0.21	0.21	0.22	0.22	0.22	0.23	0.23	0.23
Road: Jeeps: LPG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Road: Motorcycle: Four Stroke	3.36	3.47	3.53	3.59	3.64	3.70	3.76	3.83	3.89

Table 29: Emissions of black carbon from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Road: Buses: Diesel	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Road: Cars: Diesel	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Road: Truck: Diesel	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Road: Jeeps: Diesel	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11

Table 30: Emissions of organic carbon from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Road: Buses: Diesel	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Truck: Diesel	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Road: Jeeps: Diesel	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Motorcycle: Four Stroke	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table 31: Emissions of ammonia from transport in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Other or Non Specified: All: LPG Liquefied Petroleum Gas	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Road: Buses: Gasoline	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Cars: Gasoline	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22
Road: Cars: LPG	0.15	0.16	0.16	0.17	0.17	0.17	0.18	0.18	0.19
Road: Truck: Diesel	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Truck: Gasoline	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Road: Truck: LPG	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11
Road: Jeeps: Gasoline	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Road: Jeeps: LPG	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Road: Motorcycle: Four Stroke	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

2.3.1.4 Residential – 1A4a

Methodology: Emissions from residential consumption were calculated by multiplying the total fuel consumption in the residential sector, disaggregated between urban and rural areas, by fuel-specific emission factors for each pollutant.

Activity Data: Total consumption of different fuels for residential energy use in Dominican Republic (Thousand tonnes of oil equivalent).

Source: National Net Energy Balance (BNEN, in Spanish), can be downloaded from https://www.cne.gob.do/archivo/bnen-1998-al-2013-actualizado-23-abril-2015-unidades-propias/.

Emission Factors: Emission factors were included for 11 pollutants described in Section 2.1. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from the residential sector are described in Table S31-S39 for 2010-2018

Table 31: Emissions of carbon dioxide from residential in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rural: Kerosene	16.95	17.89	15.86	17.12	17.21	10.94	15.57	12.06	14.96
Rural: LPG	260.30	226.89	215.69	211.73	212.80	219.38	214.51	201.12	190.42
Urban: Kerosene	11.16	13.33	11.71	11.90	12.79	8.15	11.32	8.27	11.35
Urban: LPG	807.08	752.61	771.01	808.29	873.25	965.12	1,013.73	1,018.83	1,035.94

Table 32: Emissions of methane from residential in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rural: Charcoal	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Rural: LPG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Rural: Wood	4.98	4.88	4.76	4.71	4.73	4.74	4.75	4.69	4.69
Urban: Charcoal	0.21	0.22	0.23	0.24	0.26	0.28	0.30	0.32	0.35
Urban: LPG	0.06	0.06	0.06	0.06	0.07	0.08	0.08	0.08	0.08
Urban: Wood	0.58	0.62	0.64	0.68	0.74	0.79	0.85	0.90	0.97

Table 33: Emissions of carbon monoxide from residential in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rural: Charcoal	8.53	8.46	8.25	8.10	8.14	8.13	8.24	8.10	8.04
Rural: Kerosene	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02
Rural: LPG	0.11	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08
Rural: Wood	78.93	77.29	75.48	74.63	75.01	75.13	75.19	74.27	74.34
Urban: Charcoal	7.43	7.77	8.20	8.73	9.38	9.96	10.63	11.29	12.35
Urban: Kerosene	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
Urban: LPG	0.33	0.31	0.32	0.33	0.36	0.40	0.42	0.42	0.43
Urban: Wood	9.25	9.82	10.20	10.85	11.66	12.57	13.50	14.29	15.29

Table 34: Emissions of nitrogen dioxide from residential in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018

Rural: Charcoal	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Rural: Kerosene	0.07	0.08	0.07	0.07	0.07	0.05	0.07	0.05	0.06
Rural: LPG	0.21	0.18	0.17	0.17	0.17	0.18	0.17	0.16	0.15
Rural: Wood	2.23	2.19	2.14	2.11	2.12	2.13	2.13	2.10	2.10
Urban: Charcoal	0.08	0.09	0.09	0.10	0.11	0.11	0.12	0.13	0.14
Urban: Kerosene	0.05	0.06	0.05	0.05	0.05	0.03	0.05	0.04	0.05
Urban: LPG	0.65	0.61	0.62	0.65	0.71	0.78	0.82	0.82	0.84
Urban: Wood	0.26	0.28	0.29	0.31	0.33	0.36	0.38	0.40	0.43

Table 35: Emissions of PM2.5 from residential in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rural: Charcoal	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Rural: LPG	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Rural: Wood	6.81	6.67	6.51	6.44	6.47	6.48	6.48	6.40	6.41
Urban: Charcoal	0.09	0.10	0.10	0.11	0.12	0.13	0.13	0.14	0.16
Urban: LPG	0.08	0.08	0.08	0.08	0.09	0.10	0.11	0.11	0.11
Urban: Wood	0.80	0.85	0.88	0.94	1.01	1.08	1.16	1.23	1.32

Table 36: Emissions of volatile organic compounds from residential in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rural: Charcoal	0.33	0.33	0.32	0.31	0.31	0.31	0.32	0.31	0.31
Rural: LPG	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Rural: Wood	27.47	26.90	26.27	25.98	26.11	26.15	26.17	25.85	25.87
Urban: Charcoal	0.29	0.30	0.32	0.34	0.36	0.39	0.41	0.44	0.48
Urban: LPG	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03
Urban: Wood	3.22	3.42	3.55	3.78	4.06	4.37	4.70	4.97	5.32

Table 37: Emissions of black carbon from residential in gigagrams

Sector : Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rural: Charcoal	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Rural: Wood	0.85	0.83	0.81	0.80	0.81	0.81	0.81	0.80	0.80
Urban : Charcoal	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08
Urban : Wood	0.10	0.11	0.11	0.12	0.13	0.14	0.15	0.15	0.16

Table 38: Emissions of organic carbon from residential in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rural: Charcoal	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Rural :LPG	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rural: Wood	2.96	2.90	2.83	2.80	2.82	2.82	2.82	2.79	2.79
Urban: Charcoal	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06
Urban: LPG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Urban: Wood	0.35	0.37	0.38	0.41	0.44	0.47	0.51	0.54	0.57

Table 39: Emissions of ammonia from residential in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rural: Charcoal	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Rural: Wood	0.89	0.87	0.85	0.84	0.85	0.85	0.85	0.84	0.84
Urban: Charcoal	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06
Urban: Wood	0.10	0.11	0.12	0.12	0.13	0.14	0.15	0.16	0.17

2.3.1.5 Commercial and Public Services – 1A4b

Methodology: Emissions from the commercial and public services sector were calculated by multiplying the total fuel consumption in the commercial sector by fuel-specific emission factors for each pollutant.

Activity Data: Total consumption of different fuels for commercial and public services, disaggregated by hotels, restaurants and other services use in Dominican Republic (Thousand tonnes of oil equivalent).

> **Source:** National Net Energy Balance (BNEN, in Spanish), can be downloaded from https://www.cne.gob.do/archivo/bnen-1998-al-2013-actualizado-23-abril-2015-unidades-propias/.

Emission Factors: Emission factors were included for 11 pollutants described in Section 2.1. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from the commercial and public services sector are shown in Tables S40-S47 for 2010-2018.

Table 40: Emissions of carbon dioxide from commercial and public services in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels: Gas Diesel Oil	71.06	60.29	65.48	66.49	55.77	76.90	84.16	79.58	86.56
Hotels: LPG Liquefied Petroleum Gas	52.23	47.44	47.63	48.31	51.59	56.37	58.43	57.60	57.56
Restaurants: LPG Liquefied Petroleum Gas	55.96	50.97	50.84	51.80	55.32	60.31	62.40	61.94	61.77
Other services: LPG Liquefied Petroleum Gas	32.80	29.65	29.39	29.91	31.59	34.75	35.83	34.81	35.09

Table 41: Emissions of methane from commercial and public services in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels: Gas Diesel Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Restaurants: Charcoal	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03

Table 42: Emissions of carbon monoxide from commercial and public services in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels: Gas Diesel Oil	0.12	0.11	0.11	0.12	0.10	0.13	0.15	0.14	0.15
Hotels: LPG Liquefied Petroleum Gas	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Restaurants: Charcoal	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05
Restaurants: LPG Liquefied Petroleum Gas	0.03	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03
Other services: LPG Liquefied Petroleum Gas	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02

Table 43: Emissions of nitrogen dioxide from commercial and public services in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels: Gas Diesel Oil	0.90	0.77	0.83	0.85	0.71	0.98	1.07	1.01	1.10
Hotels: LPG Liquefied Petroleum Gas	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07
Restaurants: Charcoal	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Restaurants: LPG Liquefied Petroleum Gas	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07
Other services: LPG Liquefied Petroleum Gas	0.04	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04

Table 44: Emissions of PM2.5 from commercial and public services in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels: Gas Diesel Oil	0.09	0.08	0.08	0.09	0.07	0.10	0.11	0.10	0.11
Restaurants: Charcoal	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table 45: Emissions of volatile organic compounds from commercial and public services in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels: Gas Diesel Oil	0.05	0.04	0.04	0.04	0.04	0.05	0.06	0.05	0.06
Hotels: LPG Liquefied Petroleum Gas	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Restaurants: Charcoal	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Restaurants: LPG Liquefied Petroleum Gas	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Other services: LPG Liquefied Petroleum Gas	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table 46: Emissions of black carbon from commercial and public services in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels: Gas Diesel Oil	0.04	0.03	0.04	0.04	0.03	0.04	0.05	0.04	0.05

Table 47: Emissions of organic carbon from commercial and public services in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels: Gas Diesel Oil	0.03	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.03

2.1.6 Agriculture, Forestry and Fishing – 1A4c

Methodology: Emissions from the agriculture, forestry and fishing sector were calculated by multiplying the total fuel consumption in the sector by fuel-specific emission factors for each pollutant.

Activity Data: Total consumption of different fuels for agriculture, forestry and fishing in Dominican Republic (Thousand tonnes of oil equivalent).

> **Source:** National Net Energy Balance (BNEN, in Spanish), can be downloaded from https://www.cne.gob.do/archivo/bnen-1998-al-2013-actualizado-23-abril-2015-unidades-propias/.

Emission Factors: Emission factors were included for 11 pollutants described in Section 2.1. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from the agriculture, forestry and fishing sector are shown in Table S48 for 2010-2018.

Table S48: Emissions of GHGs, SLCPs and air pollutants from agricultural energy use (diesel consumption) in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbon dioxide	185.93	160.77	173.05	175.82	142.19	186.85	208.65	195.55	213.00
Methane	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Carbon monoxide	0.33	0.28	0.30	0.31	0.25	0.33	0.37	0.34	0.37
Nitrogen dioxide	2.36	2.04	2.20	2.24	1.81	2.38	2.65	2.49	2.71
PM2.5	0.24	0.21	0.22	0.23	0.18	0.24	0.27	0.25	0.28
Volatile organic compounds	0.13	0.11	0.12	0.12	0.10	0.13	0.14	0.13	0.14
Black carbon	0.10	0.09	0.09	0.09	0.08	0.10	0.11	0.11	0.11
Organic carbon	0.07	0.06	0.07	0.07	0.05	0.07	0.08	0.07	0.08

2.1.7 Other Energy Consumption – 1A5

Methodology: Emissions from the other energy consumption sector were calculated by multiplying the total fuel consumption in the other energy consumption sector by fuel-specific emission factors for each pollutant.

Activity Data: Total fuel consumption for other energy consumption sector.

Methodology: Emissions from the other energy consumption were calculated by multiplying the total fuel consumption in the sector by fuel-specific emission factors for each pollutant.

Activity Data: Total consumption of different fuels for other energy consumption in Dominican Republic (Thousand tonnes of oil equivalent).

Source: National Net Energy Balance (BNEN, in Spanish), can be downloaded from https://www.cne.gob.do/archivo/bnen-1998-al-2013-actualizado-23-abril-2015-unidades-propias/.

Emission Factors: Emission factors were included for 11 pollutants described in Section 2.1. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from the other energy consumption sector are shown in Tables S49-S52 for 2010-2015.

Table S49: Emissions of carbon dioxide from other energy consumption in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Gas Diesel Oil	0.91	0.93	0.62	0.94	0.69	0.56	0.66	0.59	0.69
Heavy Fuel Oil	124.03	117.59	109.85	121.71	120.06	72.14	104.11	84.84	113.77
Motor Gasoline	6.55	5.77	5.50	6.46	6.44	3.66	5.52	4.42	6.09
Refinery Gas	35.03	33.33	31.02	34.42	33.97	20.43	29.56	24.11	32.22

Table S50: Emissions of carbon monoxide from other energy consumption in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Heavy Fuel Oil	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02
Refinery Gas	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02

Table S51: Emissions of nitrogen dioxide from other energy consumption in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Heavy Fuel Oil	0.23	0.22	0.20	0.22	0.22	0.13	0.19	0.16	0.21
Motor Gasoline	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
Refinery Gas	0.05	0.05	0.05	0.05	0.05	0.03	0.05	0.04	0.05

Table S52: Emissions of PM2.5 from other energy consumption in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Heavy Fuel Oil	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.02	0.03

2.3.2 Industrial Processes Sector

2.3.2.1 Minerals – 2A

Methodology: Emissions from the mineral sector were estimated for cement production by multiplying the total mineral production by sector-specific emission factors for each pollutant. Without additional information, it was assumed that the clinker content of the cement produced was 95%, in line with the IPCC Tier 1 methodology default assumption.

Activity Data: Total annual cement production (tonnes)

Table S53: Annual cement production in the Dominican Republic

	2011	2012	2013	2014	2015
Cement Production	3,996,500	4,130,000	4,245,720	5,018,313	5,000,000

Source: USGS international mineral databook

Emission Factors: Emission factors were included for carbon dioxide and $PM_{2.5}$. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from mineral sector are shown in Tables S54 for 2010-2015.

Table S54: Emissions of carbon dioxide and $PM_{2.5}$ from cement production in gigagrams

Sector: Fuel	2010	2011	2012	2013	2014	2015
Carbon dioxide	2,028	1,974	2,040	2,097	2,479	2,470
$PM_{2.5}$	0.51	0.50	0.51	0.53	0.62	0.62

2.3.3 Agriculture Sector

2.3.3.1 Enteric Fermentation – 4A

Methodology: Emissions from enteric fermentation in the livestock sector were estimated by multiplying the number of livestock by animal-specific emission factors.

Activity Data: Number of livestock

Table S55: Number of animals in Dominican Republic (thousand animals)

Animals	2010	2011	2012	2013	2014	2015	2016	2017
Poultry	178,400	174,800	173,000	170,000	168,000	172,000	175,000	184,000

Mules and Asses	300	300	300	300	300	300	300	300
Horses	400	400	400	400	400	400	400	400
Goats	200	200	200	200	200	200	200	200
Sheep	200	300	300	300	300	300	300	300
Pigs	700	700	500	500	500	500	700	700
Other Cattle	2,900	3,000	3,000	3,000	3,000	3,000	3,100	3,000

Source: FAOStat database

Emission Factors: Emission factors were included for methane. For Greenhouse Gases, emission factors were taken from IPCC (2006), using the default emission factors for Latin America and the Caribbean provided in the guidance.

Results: The total emissions from the livestock enteric fermentation are shown in Table S56 for 2010-2015.

Table S56: Methane emissions of air pollutants, SLCPs and GHGs in 2010 from Enteric Fermentation in gigagrams

Source	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Other Cattle	**162.4**	**165.2**	**168**	**168**	**168**	**168.6**	**173.7**	**168**
Pigs	0.66	0.70	0.52	0.53	0.53	0.53	0.67	0.67
Sheep	1.20	1.23	1.23	1.24	1.25	1.25	1.25	1.25
Goats	1.13	1.15	1.16	1.18	1.18	1.18	1.13	1.12
Horses	6.30	6.30	6.34	6.39	6.39	6.42	6.46	6.46
Mules and Asses	2.91	2.91	2.97	3.00	3.00	3.00	3.00	3.01

2.3.3.2 Manure Management – 4B

Methodology: Emissions from manure management in the livestock sector were estimated by multiplying the number of livestock by animal-specific emission factors.

Activity Data: Number of livestock (shown in Table S55 above).

Emission Factors: Emission factors were included for methane and ammonia. For Greenhouse Gases, emission factors were taken from IPCC (2006), using the default emission factors for Latin America and the Caribbean provided in the guidance. For ammonia, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from the livestock manure management sector are shown in Table S57 and S58 for 2010-2017.

Table S57: Methane emissions of air pollutants, SLCPs and GHGs in 2010 from Manure Management in gigagrams

Source	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Dairy Cattle								

Other Cattle	**2.90**	**2.95**	**3.00**	**3.00**	**3.00**	**3.01**	**3.10**	**3.00**
Pigs	0.66	0.70	0.52	0.53	0.53	0.53	0.67	0.67
Sheep	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Goats	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Horses	0.77	0.77	0.77	0.78	0.78	0.78	0.79	0.79
Mules and Asses	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.36
Total	4.78	4.87	4.75	4.77	477	4.78	5.02	4.92

Table S58: Ammonia emissions of air pollutants, SLCPs and GHGs in 2010 from Manure Management in gigagrams

Source	2010	2011	2012	2013	2014	2015	2016	2017
Dairy Cattle								
Other Cattle	**26.68**	**27.14**	**27.60**	**27.60**	**27.60**	**27.69**	**28.54**	**27.60**
Pigs	4.29	4.53	3.39	3.43	3.45	3.45	4.36	4.36
Sheep	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35
Goats	0.32	0.32	0.32	0.33	0.33	0.33	0.32	0.31
Horses	5.18	5.18	5.21	5.25	5.25	5.28	5.31	5.31
Mules and Asses	4.31	4.31	4.40	4.44	4.44	4.44	4.44	4.45
Total	41.12	41.82	41.27	41.4	41.42	41.54	43.32	42.38

2.3.3.4 Savanna Burning – 4E

Methodology: Emissions from savanna burning were calculated by multiplying the total biomass burned (calculated from the total area burned multiplied by the biomass load) by emission factors for each pollutant.

Activity Data: Total area burned (hectare); Biomass load (tonnes per hectare)

Table S59: Annual Area Burned

	2010	2011	2012	2013	2014	2015	2016	2017
Annual area burned	6,804.7	9,466.5	3,456.0	7,169.6	3,498.9	8,500.5	343.5	7,034.6

Source: FAOStat

Biomass load and fraction burned: 4.9 tonnes per hectare IPCC (1996) default value.

Emission Factors: Emission factors were included for 11 pollutants described in Section 2.1. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from savanna burning are shown in Table S60 for 2010-2017.

Table S60: Annual air pollutant emissions from savanna burning

Pollutant	2010	2011	2012	2013	2014	2015	2016	2017
Methane	0.05	0.07	0.02	0.05	0.02	0.06	0.00	0.05
Carbon monoxide	1.93	2.68	0.98	2.03	0.99	2.41	0.10	1.99
Nitrogen oxides	0.14	0.20	0.07	0.15	0.07	0.18	0.01	0.15
PM2.5	0.15	0.21	0.08	0.16	0.08	0.19	0.01	0.16
Volatile Organic Compounds	0.10	0.13	0.05	0.10	0.05	0.12	0.00	0.10
Black carbon	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.01
Organic Carbon	0.07	0.09	0.03	0.07	0.03	0.08	0.00	0.07
Ammonia	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01

2.3.3.5 Field Burning of Agricultural Residues – 4F

Methodology: Emissions from the field burning of agricultural residues were estimated by multiplying the total residue burned by pollutant-specific emission factors, separately for different crops. The total residue burned was estimated from the annual crop production multiplied by a crop to residue ratio, multiplied by a dry matter fraction and the fraction of residue that is burned in fields. It was assumed that 25% of crop residues are burned in fields, as a default assumption, in the absence of country specific data.

Activity Data: Annual crop production; crop to residue ratio; dry matter fraction; fraction residue burned in fields

Annual Crop Production:

Table S61: Annual crop production in Dominican Republic (thousand tonnes)

Annual Crop Production	2010	2011	2012	2013	2014	2015	2016	2017
Sugarcane	4,577.1	4,644.5	4,865.6	4,771.2	5,033.6	4,535.3	3,980.7	5,460.8
Groundnut	3.8	4.3	3.9	5.3	5.3	5.1	5.9	6.3
Maize	35.1	35.4	41.6	45.4	36.0	34.1	41.7	44.0
Rice	850.2	874.7	664.0	723.6	532.0	535.8	556.9	588.3

Source: FAOStat

Crop-specific default values: EMEP/EEA (2016).

Emission Factors: Emission factors were included for 11 pollutants described in Section 2.1. For Greenhouse Gases, emission factors were taken from IPCC (2006), while for SLCPs and air pollutants, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook, as well as other scientific literature. The emission factors selected can be downloaded from https://energycommunity.org/default.asp?action=IBC

Results: The total emissions from the burning of agricultural residues are shown in Table S61-S68 for 2010-2017.

Table S61: Emissions of methane from crop residue burning in gigagrams

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Maize	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Rice	0.61	0.63	0.48	0.52	0.38	0.39	0.40	0.43	0.43
Sugarcane	0.24	0.24	0.25	0.25	0.26	0.23	0.21	0.28	0.28

Table 62: Emissions of carbon monoxide from crop residue burning in gigagrams

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Groundnut	0.10	0.11	0.10	0.13	0.14	0.13	0.15	0.16	0.16
Maize	0.09	0.09	0.10	0.11	0.09	0.08	0.10	0.11	0.11
Rice	13.41	13.79	10.47	11.41	8.39	8.45	8.78	9.28	9.28
Sugarcane	5.84	5.92	6.21	6.09	6.42	5.79	5.08	6.97	6.97

Table S63: Emissions of nitrogen dioxide from crop residue burning in gigagrams

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rice	0.55	0.56	0.43	0.47	0.34	0.34	0.36	0.38	0.38
Sugarcane	0.20	0.20	0.21	0.21	0.22	0.20	0.18	0.24	0.24

Table S64: Emissions of PM2.5 from crop residue burning in gigagrams

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Groundnut	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maize	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.02
Rice	1.25	1.29	0.98	1.07	0.78	0.79	0.82	0.87	0.87
Sugarcane	0.47	0.48	0.50	0.49	0.52	0.47	0.41	0.56	0.56

Table S65: Emissions of volatile organic compounds from crop residue burning in gigagrams

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Maize	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Rice	1.43	1.48	1.12	1.22	0.90	0.90	0.94	0.99	0.99
Sugarcane	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.05	0.05

Table S66: Emissions of black carbon from crop residue burning in gigagrams

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rice	0.11	0.12	0.09	0.10	0.07	0.07	0.07	0.08	0.08
Sugarcane	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.05	0.05

Table S67: Emissions of organic carbon from crop residue burning in gigagrams

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Maize	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Rice	0.75	0.77	0.59	0.64	0.47	0.47	0.49	0.52	0.52
Sugarcane	0.29	0.29	0.31	0.30	0.32	0.29	0.25	0.34	0.34

Table S68: Emissions of ammonia from crop residue burning in gigagrams

	2010	2011	2012	2013	2014	2015	2016	2017	2018

Maize	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Rice	0.55	0.56	0.43	0.47	0.34	0.34	0.36	0.38	0.38
Sugarcane	0.21	0.21	0.22	0.22	0.23	0.21	0.18	0.25	0.25

2.3.3.5 Fertilizer application

Methodology: Emissions from the application of fertilizers to fields were estimated by multiplying the total fertilizer applied (of different types), by fertilizer-specific emission factors.

Activity Data: In Table S69 below.

Table S69: Total fertilizer applied to fields (Tonnes-N per year)

Branches	2010	2011	2012	2013	2014	2015	2016	2017	2018
Other Complex NK and NPK Fertilizers	0.1	0.2	0.1	0.2	3.3	3.2	3.3	3.1	3.1
Combined Ammonium Phosphates Normal soil pH	-	-	1.9	3.7	5.6	4.9	6.1	6.8	6.8
Urea	36.4	28.9	17.0	21.0	35.2	37.0	37.6	42.1	42.1
Calcium Ammonium Nitrate	0.2	0.2	0.1	0.2	0.3	0.4	0.5	0.5	0.5
Ammonium Nitrate	1.1	3.0	1.7	1.6	2.3	1.1	1.9	2.9	2.9
Ammonium Sulphate Normal soil pH	16.1	12.7	14.9	13.6	16.2	14.9	16.8	16.2	16.2

Source: FAOStat

Emission Factors: Emission factors were included for ammonia. For ammonia, emission factors were selected from the EMEP/EEA (2016) emission inventory guidebook. The emission factors selected can be downloaded here.

Table S70: Total emissions of ammonia from fertilizer application in Dominican Republic (units: gigagrams)

Sector: Fuel	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ammonium Nitrate	0.02	0.05	0.03	0.03	0.04	0.02	0.03	0.05	0.05
Ammonium Sulphate Normal soil pH	1.48	1.17	1.37	1.25	1.49	1.37	1.55	1.49	1.49
Other Complex NK and NPK Fertilizers	0.01	0.01	0.01	0.01	0.22	0.21	0.22	0.21	0.21
Urea	5.79	4.60	2.71	3.34	5.59	5.88	5.98	6.69	6.69

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