



**REPUBLIC OF CROATIA**  
**MINISTRY OF ENVIRONMENT AND ENERGY**

**FOURTH BIENNIAL REPORT OF THE  
REPUBLIC OF CROATIA UNDER  
THE UNITED NATIONS  
FRAMEWORK CONVENTION ON  
CLIMATE CHANGE (UNFCCC)**

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1. INTRODUCTION .....	1
2. INFORMATION ON GREENHOUSE GAS EMISSIONS AND TRENDS.....	3
2.1. NATIONAL CIRCUMSTANCES .....	3
2.2. GREENHOUSE GAS EMISSIONS .....	9
2.2.1. Greenhouse gas emissions by sectors .....	9
2.2.2. Greenhouse gas emissions by gases.....	14
2.2.3. Key categories.....	20
2.2.4. Uncertainty assessment and verification.....	21
2.3. INSTITUTIONAL AND ORGANIZATIONAL STRUCTURE FOR THE PREPARATION OF THE NATIONAL INVENTORY OF THE GREENHOUSE GAS EMISSIONS .....	22
2.3.1. National system.....	22
2.3.2. National registry.....	27
3. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET.....	29
3.1. THE EU TARGET UNDER THE CONVENTION.....	29
4. PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS AND RELEVANT INFORMATION .....	35
4.1. INTRODUCTION .....	35
4.1.1. General and development policy .....	35
4.1.2. Environmental protection policy in the context of climate change mitigation .....	36
4.2. CROSS-CUTTING POLICIES AND MEASURES .....	37
4.2.1. The EU Emissions Trading System (EU ETS).....	37
4.2.2 The Effort Sharing Decision (2013-2020), Effort Sharing Regulation and LULUCF Regulation (2021-2030) .....	38
4.2.3. Other measures at EU level.....	38
4.3. SECTORAL POLICIES AND MEASURES .....	39
4.3.1. Energy.....	40
4.3.2. Transport.....	48
4.3.3. Industrial processes and product use.....	51
4.3.4. Agriculture .....	53
4.3.5. Waste.....	56
4.3.6. LULUCF.....	58
4.3.7. Other (cross-cutting) policies and measures .....	60

4.4. ASSESSMENT OF THE ECONOMIC AND SOCIAL CONSEQUENCE OF RESPONSE MEASURES .....	66
5. PROJECTIONS .....	68
5.1. INTRODUCTION .....	68
5.2. PROJECTIONS OF GREENHOUSE GAS EMISSIONS .....	70
5.2.1. Projections of greenhouse gas emissions by sectors .....	70
5.2.2. Projections of greenhouse gas emissions by gases.....	73
5.2.3. Total projections of greenhouse gas emissions .....	74
5.2.4. Emissions from sectors in the emission trading system (EU ETS) and sectors outside the emission trading system (ESD) .....	75
5.3. PROJECTION METHODOLOGY AND MODEL .....	77
5.3.1. Energy and transport .....	78
5.3.2. Industrial processes and product use .....	81
5.3.3. Agriculture .....	83
5.3.4. Waste .....	84
5.3.5. LULUCF .....	85
5.4. PROJECT SENSITIVITY ANALYSIS .....	86
5.4.1. Economic development rate (GDP rate and demographic trends).....	87
5.4.2. Influence of temperature change on heating and cooling energy.....	88
5.4.3. Hydrology in electricity production of hydroelectric power plants .....	89
5.4.4. Development of agriculture.....	89
6. PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY BUILDING SUPPORT TO DEVELOPING COUNTRIES .....	90
7. ANNEX I - CTF tables .....	91

## LIST OF TABLES AND FIGURES

### LIST OF FIGURES

<i>Figure 2-1: Trend of GHG emissions, by sectors .....</i>	<i>11</i>
<i>Figure 2-2: Trend of GHG emissions, by gases.....</i>	<i>16</i>
<i>Figure 3-1: Targets to reduce greenhouse gas emissions under the 2020 climate and energy package.....</i>	<i>31</i>
<i>Figure 3-2: National 2020 GHG emission limits under the ESD, relative to 2005 emissions levels.....</i>	<i>33</i>
<i>Figure 4-1: Overview of the strategical and planning framework for reduction of GHG emissions in the energy sector.....</i>	<i>40</i>
<i>Figure 5-1: Historical and projected greenhouse emissions by sectors, 'with existing measures' scenario .....</i>	<i>70</i>
<i>Figure 5-2: Historical and projected greenhouse emissions by sectors, 'with additional measures' scenario .....</i>	<i>70</i>
<i>Figure 5-3: Historical and projected greenhouse removals in the LULUCF, 'with existing measures' scenario .....</i>	<i>72</i>
<i>Figure 5-4: Projections of greenhouse gas emissions by gases.....</i>	<i>73</i>
<i>Figure 5-5: Total projections of greenhouse gas emissions (without removals) for period until 2035 .....</i>	<i>75</i>
<i>Figure 5-6: Historical emissions and projections of emissions within the ETS and ESD sectors, 'with existing measures' scenario .....</i>	<i>77</i>
<i>Figure 5-7: Historical emissions and projections of emissions within the ETS and ESD sectors, 'with existing measures' scenario .....</i>	<i>77</i>

### LIST OF TABLES

<i>Table 2-1: Emissions/removals of GHG by sectors for the every five years from 1990 to 2005 (kt CO<sub>2</sub>-eq).....</i>	<i>9</i>
<i>Table 2-2: Emissions/removals of GHG by sectors for the every five years from 2010 to 2013 (kt CO<sub>2</sub>-eq).....</i>	<i>10</i>
<i>Table 2-3: Emissions/removals of GHG by sectors for the every five years from 2014 to 2017 (kt CO<sub>2</sub>-eq).....</i>	<i>10</i>
<i>Table 2-4: Emissions/removals of GHG by gases for the every five years from 1990 to 2005 (kt CO<sub>2</sub>-eq).....</i>	<i>14</i>
<i>Table 2-5: Emissions/removals of GHG by gases from 2010 to 2013 (kt CO<sub>2</sub>-eq) .....</i>	<i>14</i>
<i>Table 2-6: Emissions/removals of GHG by gases from 2014 to 2017 (kt CO<sub>2</sub>-eq) .....</i>	<i>15</i>
<i>Table 2-7: Key categories summary table for 2015.....</i>	<i>20</i>
<i>Table 2-8: Data sources for GHG inventory preparation .....</i>	<i>25</i>
<i>Table 2-9: Changes in National Registry.....</i>	<i>28</i>
<i>Table 3-1: Key facts of the Convention target of the EU-28.....</i>	<i>30</i>
<i>Table 3-2: Difference to Kyoto target (kt CO<sub>2</sub> eq).....</i>	<i>34</i>
<i>Table 3-3: Annual quota amount for Croatia for the period 2013 – 2020 (kt CO<sub>2</sub>-eq).....</i>	<i>34</i>
<i>Table 5-1: Global Warming Potential .....</i>	<i>68</i>

<i>Table 5-2: Historical emissions and projections of greenhouse gas emissions by gases, kt CO<sub>2</sub>e</i>	73
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<i>Table 5-3: Historical emissions and projections of greenhouse gas emissions by sectors, kt CO<sub>2</sub>e</i>	74
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<i>Table 5-4: Historical emissions and projections of greenhouse gas emissions in ETS and ESD sectors, kt CO<sub>2</sub>e</i>	76
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## ANNEX I - CTF tables

<i>CTF Table 1 Emission trends (kt CO<sub>2</sub>e)</i>	91
<i>CTF Table 1 Emission trends (kt CO<sub>2</sub>e), cont.</i>	92
<i>CTF Table 1 Emission trends (kt CO<sub>2</sub>e), cont.</i>	93
<i>CTF Table 1(a) Emission trend (CO<sub>2</sub>)</i>	94
<i>CTF Table 1(a) Emission trend (CO<sub>2</sub>), cont.</i>	95
<i>CTF Table 1(a) Emission trend (CO<sub>2</sub>), cont.</i>	96
<i>CTF Table 1(b) Emission trend (CH<sub>4</sub>)</i>	97
<i>CTF Table 1(b) Emission trend (CH<sub>4</sub>), cont.</i>	98
<i>CTF Table 1(b) Emission trend (CH<sub>4</sub>), cont.</i>	99
<i>CTF Table 1(c) Emission trend (N<sub>2</sub>O)</i>	100
<i>CTF Table 1(c) Emission trend (N<sub>2</sub>O), cont.</i>	101
<i>CTF Table 1(c) Emission trend (N<sub>2</sub>O), cont.</i>	102
<i>CTF Table 1(d) Emission trend (HFC-i, PFC-i i SF<sub>6</sub>)</i>	103
<i>CTF Table 1(d) Emission trend (HFC-i, PFC-i i SF<sub>6</sub>), cont.</i>	104
<i>CTF Table 1(d) Emission trend (HFC-i, PFC-i i SF<sub>6</sub>), cont.</i>	105
<i>CTF Table 2(a) Description of quantified economy-wide emission reduction target: base year</i>	106
<i>CTF Table 2(b) Description of quantified economy-wide emission reduction target: gases and sectors covered</i>	106
<i>CTF Table 2(c) Description of quantified economy-wide emission reduction target: global warming potential values (GWP)</i>	107
<i>CTF Table 2(d) Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF</i>	107
<i>CTF Table 2(e)I Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention and other market-based mechanisms</i>	107
<i>CTF Table 2(e)II Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention and other market-based mechanisms</i>	108
<i>CTF Table 2(f) Description of quantified economy-wide emission reduction target: any other information</i>	108
<i>CTF Table 3 Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects</i>	109
<i>CTF Table 4: Reporting on progress</i>	167
<i>CTF Table 4(a)I_2017: Progress towards achieving a quantified economy-wide target - further information on mitigation activities relevant to the LULUCF sector in 2017</i>	168
<i>CTF Table 4(a)I_2018: Progress towards achieving a quantified economy-wide target - further information on mitigation activities relevant to the LULUCF sector in 2018</i>	169
<i>CTF Table 4(a)I_2018: Progress towards achieving a quantified economy-wide target - further information on mitigation activities relevant to the LULUCF sector in 2018, cont.</i>	170

<i>CTF Table 4(b) Report on progress.....</i>	<i>171</i>
<i>CTF Table 5 Summary of key variables and assumptions used in the projections analysis..</i>	<i>172</i>
<i>CTF Table 6(a) Information on updated greenhouse gas projections under a ‘with measures’ scenario .....</i>	<i>173</i>
<i>CTF Table 6(c) Information on updated greenhouse gas projections under a ‘with additional measures’ scenario.....</i>	<i>174</i>
<i>CTF Table 7: Provision of public financial support: summary information in 2017.....</i>	<i>175</i>
<i>CTF Table 7: Provision of public financial support: summary information in 2018.....</i>	<i>176</i>
<i>CTF Table 7 (a): Provision of public financial support: contribution through multilateral channels in 2017.....</i>	<i>177</i>
<i>CTF Table 7 (a): Provision of public financial support: contribution through multilateral channels in 2018.....</i>	<i>178</i>
<i>CTF Table 7 (b): Provision of public financial support: contribution through bi-lateral, regional and other channels in 2017.....</i>	<i>179</i>
<i>CTF Table 7 (b): Provision of public financial support: contribution through bi-lateral, regional and other channels in 2018.....</i>	<i>179</i>
<i>CTF Table 8: Provision of technology development and transfer support.....</i>	<i>180</i>
<i>CTF Table 9: Provision of capacity-building support.....</i>	<i>180</i>

## 1. INTRODUCTION

The Republic of Croatia became a party to the United Nations Convention on Climate Change (UNFCCC) on 17<sup>th</sup> January 1996 when the Croatian Parliament passed the law on its ratification (OG-IT 2/96). For the Republic of Croatia, the Convention came into force on 7<sup>th</sup> July 1996. As a country undergoing the process of transition to market economy, Croatia has, pursuant to Article 22, paragraph 3 of the Convention, took over the commitments of countries included in Annex I. By the amendment that came into force on 13 August 1998 Croatia was listed among Parties included in Annex I to the Convention.

The Republic of Croatia ratified the Kyoto Protocol in April 2007 and for Croatia it entered into force on 28 August 2007. By ratifying the Protocol (OG-IT 5/07), the Republic of Croatia, as the Protocol Annex B party, took over the obligation of limiting the greenhouse gases emissions in the period 2008-2012 by 5% compared to total emission in the base year, i.e. 1990.

At the 18<sup>th</sup> Conference of the Parties to the Convention and the 8<sup>th</sup> Conference of Parties to the Kyoto Protocol, held in December 2012 in Doha, Qatar, Croatia agreed to be covered by the amendment to Annex B of the Kyoto Protocol. Obligations for the Republic of Croatia in the second binding period of the Kyoto Protocol, from 2013 to 2020, will be jointly fulfilled by the European Union and its Member States, and Iceland. In 2015 Croatian Parliament passed the Law on the Ratification on Doha Amendment on 25 September 2015 (OG-IT 06/15). Instrument of ratification has been deposited in December 2017. The Amendment will come into force in accordance with Articles 20 and 21 of the Kyoto Protocol, i.e. by the ratification of 144 Parties, which has not yet been achieved<sup>1</sup>.

The Paris Agreement (franc. *Accord de Paris*) is the climate agreement signed at the 21<sup>st</sup> Conference of the Parties of the Convention (COP 21) in Paris, 2015. The agreement was reached on 12<sup>th</sup> December 2015 and entered into force on 4<sup>th</sup> November 2016. Paris agreement have ratified 187 Parties of 197 Parties of the Convention. The Republic of Croatia ratified the Paris Agreement on May 24<sup>th</sup> 2017 and it entered into force in the Republic of Croatia on 23<sup>rd</sup> of June 2017.

The Republic of Croatia is, pursuant to provisions in Articles 4 and 12 of the Convention, obliged to create a national greenhouse gas inventory and periodically national communication on climate change, according to which it reports on performing the obligations from the United Nations Framework Convention on Climate Change. Form and terms of submitting the national greenhouse gas inventory and national communication are defined by decisions and guidelines of the Conference of Parties.

By becoming a member of the EU on 1 July 2013, the Republic of Croatia has, due to the obligations arising from the EU *acquis communautaire*, implemented into its legal system obligations on reporting on implementation of policy and measures regarding the reduction of

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<sup>1</sup> Status on date November 6<sup>th</sup> 2019, [https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg\\_no=XXVII-7-c&chapter=27&clang=en](https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-c&chapter=27&clang=en).

emissions and increase of greenhouse gases removal and long-term emission projections that will be periodically submitted to the EU authorities.

Up to now the Republic of Croatia has prepared seven national communications and three Biennial Reports under the UNFCCC, in accordance with UNFCCC 2/CP.17 and 19/CP.18 Conferences of the Parties. Third Biennial Report was submitted to the Convention Secretariat in June 2018.

The emission calculation was made in accordance with the special instructions of the so-called. guidelines for reporting the numerical values in the standardized table system (CRF) and guidelines for the production of emission reports contained in the FCCC/CP/2002/8 document and in Decision 19/CP.18 (CTF tables for the UNFCCC, guidelines for making a two-year report for developed countries).



## 2. INFORMATION ON GREENHOUSE GAS EMISSIONS AND TRENDS

In this chapter, the results of the greenhouse gas (GHG) emissions and removals calculation are presented for the period from 1990 to 2017, as calculated in National Inventory Report of the Republic of Croatia for the Period 1990-2017 (NIR 2019)<sup>2</sup>. The summary results of the greenhouse gas (GHG) emission calculation are presented for the period from 1990 to 2017.

### 2.1. NATIONAL CIRCUMSTANCES

#### Social-political structure

The Republic of Croatia became an independent state on 8<sup>th</sup> October 1991 by a decision of the Croatian Parliament. The Croatian Constitution was adopted on 22<sup>nd</sup> December 1990. The Republic of Croatia is a member of the United Nations since 22<sup>nd</sup> May 1992 and the EU since 1<sup>st</sup> July 2013.

The state government is organized on the principle of powers division into the legislature (the Croatian Parliament), the executive (the President of the Republic, the Croatian Government) and the judicial power. The Croatian Parliament is a representative body of the citizens of the Republic of Croatia and is vested with legislative power. The government bodies comprise 20 ministries, 5 state administration offices, 7 state bureaus and 20 county offices of government bodies. The Ministry of Environment and Energy (MEE) is the central body of the state administration which performs the administration and professional affairs of environmental protection, and climate protection, among other.

#### Population

According to the 2011 Census the total number of inhabitants in the Republic of Croatia is 4,284,889, of which 2,218,554 women and 2,066,335 men. In 2011, there was 41,197 children born in the Republic of Croatia and 51,019 persons dead, which makes negative natural population growth of 9,822 persons. Since 2009 the Republic of Croatia registers negative migration saldo, i.e. more persons are moving out from the Republic of Croatia than moving in. The area of the Republic of Croatia is not equally populated. In 2011, the average population density amounted 75.7 inhabitants/km<sup>2</sup> with a range of 9.5 (Lika-Senj County) to 1,232.5 inhabitants/km<sup>2</sup> (City of Zagreb).

The Republic of Croatia has been recording very unfavourable demographic trends for many years. Demographic aging and depopulation are fundamental demographic processes in the Republic of Croatia. Croatia is one of the few European countries that has had a population decline for two decades due to negative natural growth, and the emigration of young and

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<sup>2</sup> Croatian greenhouse gas inventory for the period 1990 - 2017 (National Inventory Report 2019), Ministry of Environment and Energy, Zagreb, 2019

professionally educated people. It is estimated that there are 4,087,800 inhabitants in the Republic of Croatia in mid-2018<sup>3</sup>.

In the Republic of Croatia, there are large and growing differences between regions and micro-regions of Croatia. The development index indicates large territorial and developmental differences. The constant depopulation of rural space is also of concern.

### Economy

Gross Domestic Product (GDP) in 2017 amounted to HRK 365.64 billion (EUR 49.01 billion), which amounts to HRK 89.180 per capita (EUR 11.954 per capita).

After the Croatian economy grew at an average annual rate of 4.3% from 2000 to 2008, comparable to the growth of the new EU member states, in 2009 a prolonged recession began - the depression. In 2014, real GDP was 12.4% lower than in 2008. The physical volume of industrial production decreased by 17% from 2008 to 2014, with activity in the construction industry declining even more.

The economic recovery began in 2015. The GDP growth rate in 2015 was 2.4%, in 2016 3.5%, in 2017 2.9% and in 2018 2.7%. Current indicators of economic activity and the expected continued growth in investment activity of the public as well as the private sector and household consumption suggest that real GDP growth in 2019 could be around 2.8%.

The Croatian economy is in the process of structural transformation from an economy dependent on domestic demand and construction investment to an internationally competitive, export-oriented economy, in which tourism, IT and other services play an important role. Better use of European Structural and Investment Funds also contributes to accelerating growth. At the end of 2018, a total of 1.76 billion euros was invested, or 16% of the total allocation for the seven-year period (2014-2020). There was a significant increase in published tenders and contracted projects as well. The efficiency of using EU funds is expected to increase in the coming years.

Economic growth and fiscal discipline on the side of budget expenditures in 2015 and 2016 halted the growth of the budget deficit and public debt, whose ratios to GDP began to decline. The deficit was below 2% of GDP in 2017 and 2018, and the public debt-to-GDP ratio stood at 74.6% at the end of 2018. Croatia's credit rating is an investment with a positive outlook.

### Geographic profile and land use

According to its position, the Republic of Croatia belongs to the Central European, Adriatic-Mediterranean and Pannonia-Danube group of countries. Total area of the Republic of Croatia amounts 87,661 km<sup>2</sup>. The inland area amounts 56,594 km<sup>2</sup>, while the area of territorial sea and internal waters amounts 31,067 km<sup>2</sup>. Total length of inland borders of the Republic of Croatia towards neighbouring countries amounts 2,374.9 km (including river borders). The state sea

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<sup>3</sup> Croatian Bureau of Statistics, <https://www.dzs.hr/>

border is 948 km long and extended at outer boundary of territorial sea. The Ecological and Fisheries Protection Zone of 23,870 km<sup>2</sup> reaches epicontinental border between the Republic of Croatia and Italy. In 2017, used agricultural area occupied 26.7%, while forest area occupied 37 % of the Republic of Croatia territory. Protected areas occupy 8.54% of the total area of the Republic of Croatia: 12.22% of the land territory and 1.94 % of the territorial sea. A majority of protected area are nature parks (4.90% of the total state territory).

### Climate

According to Köppen classification for a standard period 1961-1990, the largest part of Croatia belongs to the climate type C, a moderately warm rainy climate with an average monthly temperature of the coldest month above -3 ° C and below 18 ° C. Only the highest parts of the Lika and Gorski Kotar mountains (> 1,200 m above sea level) have a snow-forest climate of D with an average temperature of the coldest month lower than -3 ° C. The average annual air temperature in the lowland region of northern Croatia is 10 - 12 ° C, at altitudes above 400 m it is lower than 10 ° C, while in the highest mountains it is 3 - 4 ° C. The coastal zone is 12 - 17 ° C. The coldest parts of the Republic of Croatia are the areas of Lika and Gorski kotar with temperatures of 8 ° C - 10 ° C at lower altitudes and 2 ° C - 4 ° C at the highest peaks of the Dinaric Highlands. The average annual rainfall in the Republic of Croatia ranges between 600 mm and 3,500 mm. The average annual rainfall reaches a maximum of up to 3,500 mm at the top of the mountains in Gorski Kotar (Risnjak and Snježnik). The least rainfall in Croatia falls on the outer islands of the central Adriatic (less than 400 mm) and in eastern Slavonia and Baranja up to 700 mm. In central Croatia, annual precipitation is between 900 and 1,000 mm. Rainfall in the Pannonian region decreases from west to east. From the coast inland, the amount of rainfall increases. In the interior of the Republic of Croatia, winds from the northeast and southwest winds prevail. In strength, they are usually weak to moderate. The sunniest parts of the Republic of Croatia are the outer islands of the central Adriatic (Vis, Lastovo, Bisevo and Svetac) and the western coasts of Hvar and Korcula, with more than 2,700 hours of sunshine a year. The northernmost part of Croatia, with an annual cloudiness of about 4 to 4.5 tenths, is the coastal area of the Central and Southern Adriatic. Most mainland Croatia has 1,700-2,000 hours of sunshine. The highest annual cloud cover is in Gorski Kotar (6 - 7 tenths), and the duration of sunshine is at least 1,700 hours per year.

### Energy

The total primary energy production decreased by 5.7% with relation to the 2016. Comparing to 2016, the energy production from renewable sources increased by 27.0% in 2017.

The production of natural gas decreased 10.0% as well as production of hydro power (18.0%). Crude oil production increased by 1.0% as well as fuel wood (0.8%). While in 1990 the share of crude oil in primary energy production was the highest one with 38.9%, in 2017 its' share

was only 14.5%. In 2017, the share of fuel wood (29.6%) was the highest one. It was followed by hydro power with the share of 24.6%.

In 1990 primary energy supply was about 430.8 PJ, which is 3.9% higher comparing to 2017. In 2017, the total primary energy supply increased by 2.1% with relation to the previous year. There was an increase in renewable energy sources, natural gas and liquid fuels while consumption of coal and coke, hydro power and fuel wood decreased. Due to bad hydrology conditions, hydro power energy supply decreased by 6.9% with relation to the 2016.

### Transport

The total length of roads in 2016 was amounted to 26,953 km.

The number of registered road vehicles in 2018 was 2,192,857, which is 4.5% higher comparing to 2017. The number of registered passenger cars in 2018 was 1,666,413, which is 4.4% higher comparing to 2017.

The length of the railway lines has been reduced since 2006 and totals 2,604 km, of which 2,350 km are single track and 254 km are two track. In 2018, 970 km of railways were electrified, representing 37.3% of the total length of the railways.

The Republic of Croatia has 6 ports of international economic interest in the cities of Rijeka, Zadar, Šibenik, Split, Ploče and Dubrovnik. The inland waterway network of the Republic of Croatia is 804 km, of which 539 km are international waterways. Inland ports open to international public transport are: Osijek, Sisak, Slavonski Brod and Vukovar. There are 7 civilian airports in the Republic of Croatia: Zagreb, Dubrovnik, Split, Zadar, Osijek, Pula, Rijeka, Brač and Mali Lošinj.

Pipeline transportation includes the transportation of oil and gas. In 2018, the length of the pipeline was 610 km and has not changed since 2005. The pipeline length was 2,693 km in 2018.

### Industry

Industrial production in the Republic of Croatia, until the onset of the recession, held a significant place in total production. The manufacturing, petrochemical industries and shipbuilding were standing out. Some companies were shut down in the transition process or were damaged in the war. Most of this applies to the textile, leather, metal and wood factories. Production in the construction and energy sectors was also significant. However, some industries continue to achieve positive results and participate in foreign trade.

The value of sales of industrial products in 2018 amounted to HRK 140.825 billion. Compared to the previous year, the value of sales increased by HRK 5,984 million, which is 4.4%. The value of sales to the foreign market amounts to HRK 59,747 million, which is 42.4% of the total value of sales of industrial products.

Data on total exports in 2017 show that the most represented industries are the production of basic pharmaceutical products and pharmaceutical preparations (8.2%), the production of food products (7.7%), the production of coke and refined petroleum products (7.3%), manufacture of machinery and equipment (7.0%), manufacture of fabricated metal products, except machinery and equipment (6.8%), etc.

### Waste management

In 2017, a total of 1,716,441 tonnes of municipal waste was produced. All municipalities and cities had organized collection and disposal of municipal waste. The annual amount of municipal waste per capita was 416 kg. The share of mixed municipal waste in the collected waste was 72% or 1,228,232 tonnes. The share of other types of municipal waste in total municipal waste was 28%.

Of the total amount of municipal waste produced, 72% of municipal waste was sent to landfills, and 24% of municipal waste was sent for recovery. The remaining 4% consists of quantities of temporarily stored waste. In the period from 1997 to 2010, the quantities of landfilled biodegradable municipal waste increase with the increase in the quantities of biodegradable municipal waste produced. From 2011 onwards, despite the recorded increase in the quantities produced, the quantities sent to landfills have nevertheless declined as a result of the implementation of measures for separate collection of municipal waste and the construction of two waste management centers. The amount of biodegradable municipal waste produced in 2017 was 1,091,066 tonnes. The amount of biodegradable municipal waste sent to landfills for 2017 amounts to 801,238 tonnes. In 2017, separate collection of bio-waste increased by 2% compared to 2016, and is amounted to 13%, as in previous year. About 11% of bio-waste produced is being forwarded to recovery (composting, anaerobic digestion), while the rest ends up in landfills. The recycling rate in 2017 is 24%.

### Construction and housing

After six years of economic crisis marked by a significant decline in construction work and employment, 2015 brought a slowdown in negative trends and the first signs of recovery. Activity stabilization continued in 2016. In 2017 and 2018 the recovery in the construction sector was more expressed. Analysing the annual rates of change in the main sectoral indicators in 2018, a slight increase in the volume of construction works and an increase in the number of newly built dwellings are observed. The total value of construction work in 2018 amounted to approximately HRK 2.9 billion, which is 6.4% comparing to 2017.

### Agriculture

In 2016 from the total agriculture area (2.7 mil. ha) intensively used agricultural land was 1,562,983 ha which represents 27.9% of the total land area of the Republic of Croatia.

In 2017, the total utilized agricultural area amounts to 1,496,663 ha, which is 26.73% of the total land area of the Republic of Croatia. The most represented category in 2017 are arable land and gardens with 54.5% and permanent grassland with 40.6%.

The physical volume of agricultural gross production in 2017, compared to the previous year, decreased by 8.5%. The decline in the physical volume of agricultural production was due to a decrease in the physical volume of plant production by 15.2%, while livestock production recorded an increase in the physical volume of production by 0.9%. In total gross production in 2017, crop production accounts for 54.1% and livestock production for 45.9%.

The total catch and farming (production) of marine fish and other marine organisms in 2017 decreased by 1,710 tonnes or 2.0% compared to the previous year. Blue fish decreased by 4.4%, while other fish increased by 10.7% and shellfish by 17.3%. Of the total catches of blue fish, the largest share is attributed to sardine catches (76.6%). The catch and farming of oysters, other molluscs and shellfish was reduced by 263 tonnes (9.9%). Total freshwater fish production in 2017 decreased by 762 tonnes (18.9%). Of the total freshwater fish produced, 62.3% related to carp production and 12.1% to trout production. In the Republic of Croatia, fish young are also being farmed of which 3,446 tons were farmed in 2017.

### Forestry

Forests in the Republic of Croatia cover 37% of the total state territory and together with forest land make up a unique forest management area on 2,485,300 ha of total area, which represents 44% of the total land area of the Republic of Croatia. Of these, 81% are state-owned forests and are managed by Croatian Forests Ltd., and the remaining 19% are privately owned. The main feature of the forests of the Republic of Croatia is that they are 95% natural unlike many European forests that are not.

The valid Forest Management Plan for the Republic of Croatia in the period from 2016 to 2025 determined that the wood supply in the Republic of Croatia amounts to 418,618,277 m<sup>3</sup>, with the annual increase of about 10.1 million m<sup>3</sup>. Wood stock of the forest management area in 2016 compared to 2006 increased by 5%. In the total wood stock the most common species are deciduous species: common beech (37.2%), Pedunculate oak (11.6%) and Sessile oak (9.4%). Of the coniferous species, the most common are common meals (7.9%), common spruce (2.3%) and black pine (1.4%).

### Inland waters and coastal area

All surface and ground waters are part of either Black Sea or Adriatic catchment area with the watershed running along the mountain and alpine area. Large watercourses dominate the Black Sea catchment area. In the Adriatic catchment area, the abundance and the length of surface watercourses are significantly lower. The majority of large watercourses of the Black Sea catchment area is of interstate significance (boundary or cross-border). The river of Danube is the largest and richest in water, flowing through the eastern borderland of the Republic of Croatia, while the rivers of Sava and Drava have the longest courses in the Republic of Croatia.

There are not many natural lakes in the Republic of Croatia. The largest natural lakes are Vrana Lake near Pakoštane, Dubravsko, Peruća, Prokljan Lake and Vrana Lake on the island of Cres. The Republic of Croatia is also characterized by significant wetland areas. Locations included in the Ramsar list are: Kopački rit in the Drava and Danube catchments, Lonjsko and Mokro polje and Crna Mlaka in the Sava catchment, lower Neretva part in the Adriatic catchment and Vrana Lake near Pakoštane. The Adriatic Sea is the northernmost part of the Mediterranean Sea. The total length of Croatian coast is 6,278 km, out of which 1,800 km belongs to the mainland and 4,200 km to the island coastline. The highest measured depth is 1,233 m. The Croatian islands include almost all islands of the Adriatic eastern coast and its central part making the second Mediterranean archipelago by size. There are 1,244 islands which are geographically distinguished as 79 islands, 525 islets, 640 cliffs (top above sea-level) and reefs (top below sea-level).

#### Other national circumstances

Contamination with mines left over as a result of the war operations in the Republic of Croatia causes a whole range of economic, developmental and social disturbances, in particular, the problem of security of the population in areas that were in the fields of war. Defined size of mine suspected area in the Republic of Croatia on the 1<sup>st</sup> December 2018 was amounted to 355.5 km<sup>2</sup>, which present 0.64% of the land area of the Republic of Croatia. The largest share in the mine suspected area of the Republic of Croatia consists of forest areas with 95.7% of total mine suspected area, then agricultural area with 4.0% of suspected hazardous area. Counties of Lika-Senj, Sisak-Moslavina and Osijek-Baranja are the most mine polluted counties accounting for 64% of total mine polluted areas in the Republic of Croatia.

## 2.2. GREENHOUSE GAS EMISSIONS

### 2.2.1. Greenhouse gas emissions by sectors

The results of the calculation of greenhouse gas (GHG) emissions are presented for the period from 1990 to 2017.

This chapter presents national emissions and removals in the Republic of Croatia for the period from 1990 to 2017 shown as total emissions of all greenhouse gases as equivalent carbon dioxide (CO<sub>2</sub>) emissions by sector. **Pogreška! Izvor reference nije pronađen.**, Table 2-2, Table 2-3 i **Pogreška! Izvor reference nije pronađen.** show the total GHG emissions and removals trend by sector.

Table 2-1: Emissions/removals of GHG by sectors for the every five years from 1990 to 2005 (kt CO<sub>2</sub>-eq)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1995	2000	2005
	CO <sub>2</sub> equivalent (kt)			
1. Energy	21,729.7	16,033.75	18,250.9	21,595.8

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1995	2000	2005
	CO <sub>2</sub> equivalent (kt)			
2. Industrial processes and product use	4,677.5	2,468.78	3,137.0	3,574.0
3. Agriculture	4,399.6	3,265.24	3,133.5	3,324.1
4. Land use, land-use change and forestry	-6,654.6	-9,063.17	-6,966.7	-7,767.1
5. Waste	1,051.4	1,168.98	1,339.4	1,518.4
6. Other	NO	NO	NO	NO
<b>Total (with LULUCF)</b>	<b>25,203.8</b>	<b>13,873.6</b>	<b>22,245.3</b>	<b>22,245.3</b>
<b>Total (without LULUCF)</b>	<b>31,858.4</b>	<b>22,936.8</b>	<b>30,012.3</b>	<b>30,012.3</b>

Table 2-2: Emissions/removals of GHG by sectors for the every five years from 2010 to 2013 (kt CO<sub>2</sub>-eq)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013
	CO <sub>2</sub> equivalent (kt)			
1. Energy	19,747.2	19,486.7	18,060.5	17,304.8
2. Industrial processes and product use	3,332.4	3,171.0	2,879.3	2,638.5
3. Agriculture	3,094.3	3,189.4	3,034.9	2,786.3
4. Land use, land-use change and forestry	-7,116.3	-6,019.7	-5,646.6	-6,402.0
5. Waste	1,910.9	1,941.9	1,941.1	1,824.9
6. Other	NO	NO	NO	NO
<b>Total (with LULUCF)</b>	<b>20,968.4</b>	<b>21,769.3</b>	<b>20,269.2</b>	<b>18,152.6</b>
<b>Total (without LULUCF)</b>	<b>28,084.7</b>	<b>27,788.9</b>	<b>25,915.7</b>	<b>24,554.5</b>

Table 2-3: Emissions/removals of GHG by sectors for the every five years from 2014 to 2017 (kt CO<sub>2</sub>-eq)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2014	2015	2016	2017
	CO <sub>2</sub> equivalent (kt)			
1. Energy	16,364.0	16,604.0	16,966.5	17,349.2
2. Industrial processes and product use	2,775.6	2,800.1	2,493.6	2,731.5
3. Agriculture	2,702.2	2,879.6	2,816.9	2,844.6
4. Land use, land-use change and forestry	-6,448.6	-5,434.5	-5,543.6	-4,766.6
5. Waste	1,920.9	1,963.7	2,107.8	2,094.4
6. Other	NO	NO	NO	NO
<b>Total (with LULUCF)</b>	<b>17,314.1</b>	<b>18,812.9</b>	<b>18,841.2</b>	<b>20,253.2</b>
<b>Total (without LULUCF)</b>	<b>23,762.7</b>	<b>24,247.4</b>	<b>24,384.8</b>	<b>25,019.7</b>



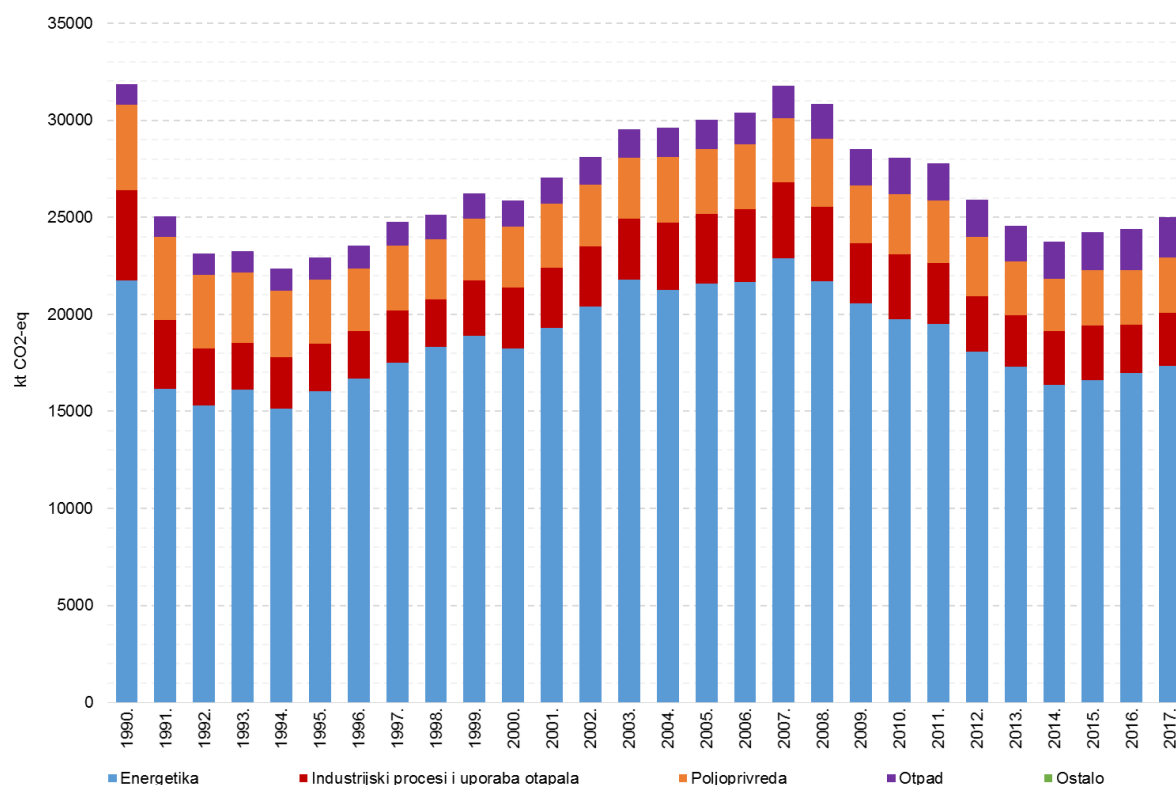


Figure 2-1: Trend of GHG emissions, by sectors

The largest contribution to the GHGs emission in 2017 excluding LULUCF has the Energy sector with 69.3 percent, followed by Agriculture with 11.4 percent, Industrial Processes and product use with 10.9 percent and Waste with 8.4 percent. This structure is with minor changes consistent through all the observed period from 1990 to 2017. In the year 2017, the total GHG emissions in Croatia was 25,019.7 kt CO<sub>2</sub>-eq excluding LULUCF sector while the total emission was 20,253.2 kt CO<sub>2</sub>-eq including the LULUCF sector which represents removals by sink from 19.1 percent in that year.

### Energy sector

Energy sector is the largest contributor to GHG emissions. In the year 2017, the GHG emission from Energy sector was 2.3 percent higher in relation to 2016 and 20.2 percent lower in relation to 1990. The Energy sector is the main cause for anthropogenic emission of greenhouse gases. It accounts approximately 70 percent of the total emission of all greenhouse gases presented as equivalent emission of CO<sub>2</sub>. Looking at its contribution to total emission of carbon dioxide (CO<sub>2</sub>), the energy sector accounts for about 90 percent. The contribution of energy in methane (CH<sub>4</sub>) in total CO<sub>2</sub>-eq emission is substantially smaller (8 percent) while the contribution of energy in nitrous oxide (N<sub>2</sub>O) in total CO<sub>2</sub>-eq emission is quite small (about 2 percent). Emissions from fossil fuel combustion comprise the majority (more than 95 percent) of energy-related emissions.

The largest part (38.3 percent in 2017) of the emissions are a consequence of fuel combustion in Transport, then the combustion in Energy industries (25.9 percent in 2017) and the

combustion in small stationary energy sources, such as Commercial/ Institutional, Residential and Agriculture/ Forestry/ Fishing (19.0 percent in 2017). Manufacturing Industries and Construction contribute to total emission from Energy sector with 13.9 percent, while Fugitive Emissions from Fuels contribute with about 2.9 percent.

#### Industrial processes and product use

In Industrial Processes sector, the key emission sources are part of Mineral industry, Chemical industry and Product uses as ODS substitutes, which all together contribute with 94.9 percent in total sectoral emission in 2017. The iron production in blast furnaces and aluminium production ended in 1992, and ferroalloys production ended in 2003. Generally, GHG emissions from industrial processes declined from 1990 to 1995, due to the decline in industrial activities caused by the war in Croatia, while in the period 1996 - 2008 emissions slightly increased due to revitalization of the economy. The effects of the economic crisis influenced the emissions trend from 2008 onwards, followed by a moderate recovery since 2013. The decrease in emissions from chemical industry in 2013 and onwards is due to a strong reduction of N<sub>2</sub>O emissions from the nitric acid production after applying abatement technology. In 2017 emissions from industrial processes were increased by 9.5 percent regarding 2016 and decreased by 58.4 percent regarding 1990. Industrial processes and product use contributed to total GHG emissions with 10.9 percent in 2017.

#### Agriculture

Emission of CH<sub>4</sub> and N<sub>2</sub>O in the Agricultural sector is conditioned by different agricultural activities. For the emission of CH<sub>4</sub>, the most important source is livestock farming (Enteric Fermentation) which makes 38.9 percent of sectoral CO<sub>2</sub>-eq emission. The number of cattle showed continuous decrease in the period from 1990 to 2000. As a consequence, this led to CH<sub>4</sub> emission reduction. In the year 2000, the number of cattle has started increasing and this trend was mostly retained until 2006. From 2007 to 2010, cattle number decreased and remained at approximately the same level in 2013 and 2014. Compared to 2016, in 2017 CO<sub>2</sub>-eq emission from Enteric fermentation decreased by 6.1 percent. As for Manure management emissions, CO<sub>2</sub>-eq emission decreased by 5.0 percent in 2017 compared to 2016. Emissions from Agricultural soils decreased after 1990 and during the war due to specific national circumstances and limited agricultural practice at that time. Afterwards, the emission trend is mostly influenced by the changes in the direct soil emissions; thus, emission increase can be noticed in 1997, 2001 and 2002 due to increase in mineral fertilizer consumption and crop production, later on also due to the increase of livestock population. CO<sub>2</sub>-eq emission from Agricultural soils increased in 2017 compared to 2016 by 13.0 percent. Overall, in the year 2017 the GHG emission from Agriculture sector increased by 1.0 percent in comparison with 2016.

#### LULUCF

The Act on Forest (Official Gazette No. 68/18, 115/18) regulates the growing, protection, usage and management of forests and forest land as a natural resource aimed to maintain biodiversity

and ensure management based on principles of economic sustainability, social responsibility and ecological acceptability. Moreover, one of its the most important provisions, in the context of climate protection, is that forests should be managed in conformity with the sustainable management criteria, implying the maintenance and enhancement of forest ecosystems and their contribution to the global carbon cycle. Planning activities in forestry sector in Croatia are also regulated by the Law on Forest. Forest management plans determine conditions for harmonious usage of forest and forest land and procedures in that area, necessary scope regarding cultivation and forest protection, possible utilization degree and conditions for wildlife management. The Forest Management Area Plan (FMAP) for the Republic of Croatia determines the ecological, economic and social background for forest improvement in terms of biology and for the increase of forest productivity.

According to Forest Management Area Plan of the Republic of Croatia (2006-2017), the forests and the forest land cover 47.5 percent of the total surface area. By its origin, approximately 95 percent of the forests in Croatia were formed by natural regeneration (according to the national definitions applied in the sector) and the 5 percent of the forests are grown artificially. The Plan determines, for 2006, growing stock of about 398 millions of m<sup>3</sup> while its yearly increment amounts around 10.5 million of m<sup>3</sup>. The most frequent species are Common Beech (*Fagus sylvatica*), Pedunculate Oak (*Quercus robur*), Sessile Oak (*Quercus petraea*), Common Hornbeam (*Carpinus betulus*), Silver Fir (*Abies alba*), Narrow-leafed Ash (*Fraxinus angustifolia*), Spruce (*Picea abies*), Black Alder (*Alnus glutinosa*), Black Locust (*Robinia pseudoacacia*), Turkey Oak (*Quercus cerris*) and other. The methodology used for CO<sub>2</sub> removal calculation is taken from the IPCC and it is based on data on increment and fellings. The problem of deforestation in Croatia does not exist. According to present data the total forest area has not been reduced in the last 100 years.

Removal share in the LULUCF sector contribute with 23.5 percent to the total emissions of CO<sub>2</sub>eq in year 2017.

### Waste

Waste sector includes following categories: solid waste disposal, biological treatment of solid waste, incineration and open burning of waste and wastewater treatment and discharge. Solid waste disposal represents dominant CH<sub>4</sub> emission source from that sector. Generally, 84.8 percent of sectoral emissions refer to the emissions from solid waste disposal in 2017, compared to 51.3 percent in 1990. An increase in generated solid waste exists during the entire reporting period, particularly until 2009. Starting with 2009 there is a decrease in registered waste quantities, caused primary by economic crisis but also other factors regarding to effects of measures undertaken to avoid/reduce and recycle waste. 14.9 percent of sectoral emissions refer to the emissions from wastewater treatment and discharge in 2017, compared to 48.7 percent in 1990. Decrease in emissions during the entire reporting period mainly is a result of population decrease (domestic wastewater) as well economic crisis that affected the reduction of economic activity from 2008 onwards (industrial wastewater). Biological treatment of solid waste and incineration and open burning of waste have considerably lower contribution to the sectoral

emissions during the reporting period. Waste sector contributes to total GHG emissions with 8.5 percent in 2017.

## 2.2.2. Greenhouse gas emissions by gases

This chapter presents national emissions and removals of greenhouse gases in the Republic of Croatia for the period 1990-2017 shown as total emissions of all greenhouse gases as equivalent carbon dioxide (CO<sub>2</sub>) emissions. The contribution of individual gases is shown in Table 2-4, Table 2-5, Table 2-6 and Figure 2-2.

Table 2-4: Emissions/removals of GHG by gases for the every five years from 1990 to 2005 (kt CO<sub>2</sub>-eq)

Greenhouse gas emissions	1990	1995	2000	2005
	CO <sub>2</sub> equivalent (kt)			
CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	23,337.1	16933.29	19,699.2	23,383.8
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	16,648.5	7824.44	12,533.7	15,540.0
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	4,423.8	3662.49	3,523.6	3,886.6
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	4,425.1	3670.03	3,620.5	3,889.3
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	2,846.7	2300.53	2,478.5	2,463.1
N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	2,879.5	2338.67	2,580.5	2,537.1
HFCs	NO	29.32	147.9	265.8
PFCs	1.240,2	NO	NO	NO
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO
SF <sub>6</sub>	10,5	11,1	11,6	13,0
NF <sub>3</sub>	NO	NO	NO	NO
<b>Total (without LULUCF)</b>	<b>31,858.4</b>	<b>22936.8</b>	<b>25,860.9</b>	<b>30,012.3</b>
<b>Total (with LULUCF)</b>	<b>25,203.8</b>	<b>13873.6</b>	<b>18,894.2</b>	<b>22,245.3</b>
<b>Total (without LULUCF, with indirect)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>Total (with LULUCF, with indirect)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

Table 2-5: Emissions/removals of GHG by gases from 2010 to 2013 (kt CO<sub>2</sub>-eq)

Greenhouse gas emissions	2010	2011	2012	2013
	CO <sub>2</sub> ekvivalent (kt)			
CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	21,064.5	20,699.0	19,115.9	18,454.7
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	13,864.8	14,566.5	13,323.1	11,968.7
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	4,191.5	4,178.9	4,105.2	3,918.1
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	4,193.2	4,197.6	4,144.0	3,920.1
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	2,440.9	2,505.4	2,288.2	1,706.5

N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	2,522.5	2,599.6	2,395.6	1,788.5
HFCs	378.9	396.2	397.3	469.2
PFCs	0.0	0.0	0.0	NO
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO
SF <sub>6</sub>	9,0	9,4	9,2	6,1
NF <sub>3</sub>	NO	NO	NO	NO
<b>Total (without LULUCF)</b>	<b>28,084.7</b>	<b>27,788.9</b>	<b>25,915.7</b>	<b>24,554.5</b>
<b>Total (with LULUCF)</b>	<b>20,968.4</b>	<b>21,769.3</b>	<b>20,269.2</b>	<b>18,152.6</b>
<b>Total (without LULUCF, with indirect)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>Total (with LULUCF, with indirect)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

Table 2-6: Emissions/removals of GHG by gases from 2014 to 2017 (kt CO<sub>2</sub>-eq)

Greenhouse gas emissions	2014	2015	2016	2017
	CO <sub>2</sub> ekvivalent (kt)			
CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	17,708.1	17,840.7	18,082.5	18,716.8
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	11,178.4	12,301.7	12,442.8	13,751.3
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	3,928.1	4,102.7	4,223.5	4,108.3
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	3,928.4	4,116.6	4,232.4	4,177.5
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	1,645.0	1,816.3	1,588.9	1,699.6
N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	1,725.8	1,906.8	1,676.0	1,829.3
HFCs	474.8	482.5	483.5	488.7
PFCs	NO	NO	NO	NO
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO
SF <sub>6</sub>	6,8	5,2	6,4	6,4
NF <sub>3</sub>	NO	NO	NO	NO
<b>Total (without LULUCF)</b>	<b>23,762.7</b>	<b>24,247.4</b>	<b>24,384.8</b>	<b>25,019.7</b>
<b>Total (with LULUCF)</b>	<b>17,314.1</b>	<b>18,812.9</b>	<b>18,841.2</b>	<b>20,253.2</b>
<b>Total (without LULUCF, with indirect)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
<b>Total (with LULUCF, with indirect)</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

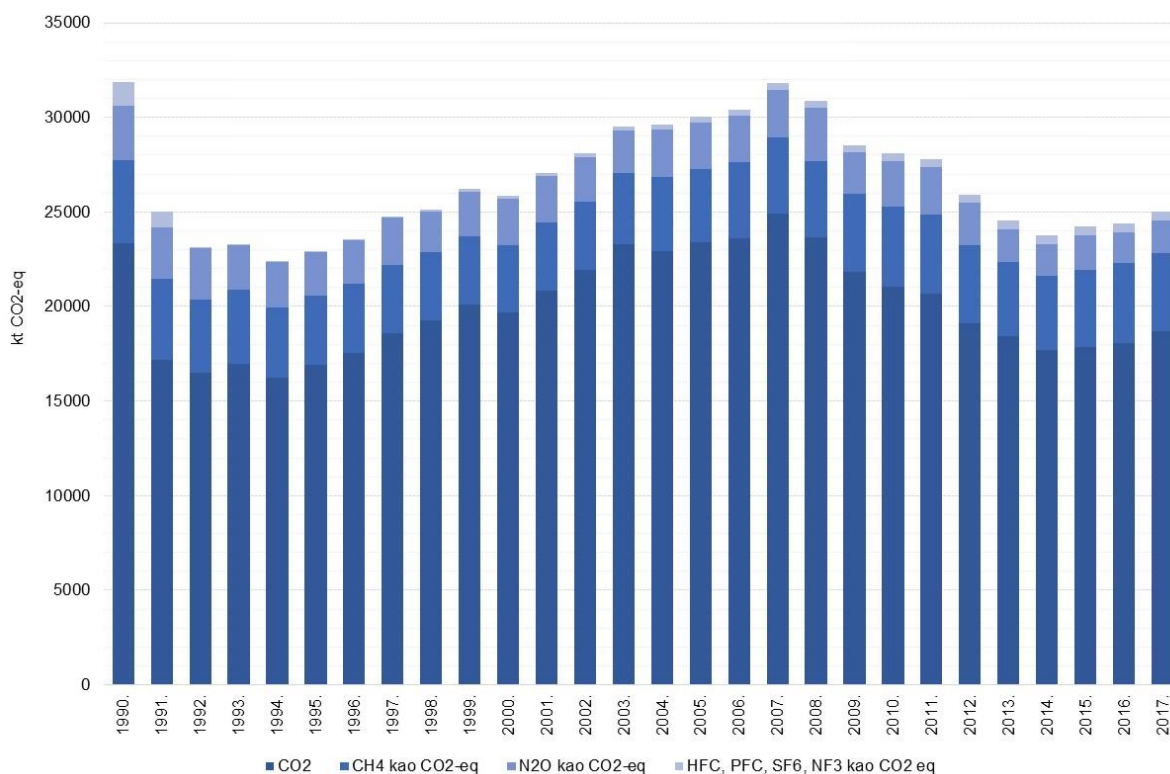


Figure 2-2: Trend of GHG emissions, by gases

The largest contribution to the GHGs emission in 2017 excluding LULUCF has CO<sub>2</sub> emission with 74.8 percent, followed by CH<sub>4</sub> with 16.4 percent, N<sub>2</sub>O with 6.8 percent and HFCs, PFCs and SF<sub>6</sub> with 2.0 percent.

### Carbon dioxide (CO<sub>2</sub>)

Carbon dioxide is the most significant anthropogenic GHG. The most significant anthropogenic sources of CO<sub>2</sub> emissions in Croatia are the processes of fossil fuel combustion for electricity or/and heat production, transport and industrial processes (cement and ammonia production).

The energy most intensive stationary sub-sector is Energy Industries (electricity and heat production, refineries and oil and gas field combustion). In the framework of the sub-sector Manufacturing Industries and Construction, the largest CO<sub>2</sub> emissions are the result of fuel combustion in industry of construction material and petrochemical production, followed by food processing industry, chemical industry, industry of pulp, paper and print, iron and steel industry and non-ferrous metal industry. Furthermore, this sub-sector includes electricity and heat production in manufacturing industry for manufacturing processes.

Transport sub-sector is also one of more important CO<sub>2</sub> emission sources. This sector includes emission from road transport, civil aviation, railways and navigation. In the year 2017, the CO<sub>2</sub> emission from Transport sector contributed with 35.1 % to the national total CO<sub>2</sub> emission. The largest part of the CO<sub>2</sub> emission from Transport sector arises from road transport (96.5% of

CO<sub>2</sub> emission from transport sector in 2017) followed by national navigation, domestic civil aviation and railways.

Biomass combustion (fuel wood and waste wood, biodiesel, biogas) also results in greenhouse gas emissions. CO<sub>2</sub> emission from biomass is not included in balance according the Guidelines, due to assumption that life-cycle CO<sub>2</sub> emitted is formerly absorbed for the growth of biomass. Sinks or CO<sub>2</sub> emissions resulted in change of forest biomass is calculated in LULUCF sector.

Fugitive GHG emission from coal, liquid fuels and natural gas, resulted from exploration of minerals, production, processing, transport, distribution and activities during mineral use is also included in this sector.

The most significant CO<sub>2</sub> industrial processes emission sources are production of cement, ammonia and lime. In 2017, mineral industry contributes in total sectorial CO<sub>2</sub> emission with 69.3% and chemical industry with 27.3%. Generally, CO<sub>2</sub> emissions from industrial processes declined from 1990 to 1995, due to the decline in industrial activities caused by the war in Croatia, while in the period 1996-2008 emissions slightly increased. Production of iron and aluminium was stopped in 1992. A decrease of economic activities after 2008 influenced a reduction in cement, lime, ammonia and steel productions. In 2015 CO<sub>2</sub> emissions from industrial processes decreased by 12.9 % compared to year 2016.

#### Methane (CH<sub>4</sub>)

The major sources of methane (CH<sub>4</sub>) emission are fugitive emission from production, processing, transportation and activities related with fuel use in Energy sector, Agriculture and Waste Disposal on Land. In the Agricultural sector there are two significant methane emission sources present: enteric fermentation in the process of digestion of ruminants (dairy cows represent the major source) and different activities related with storage and use of organic fertilizers (manure management). The total methane emission for domestic animals is being calculated as a sum of emission from enteric fermentation and emission related to manure management. The emission trend depends on the livestock population trend.

Methane emission from solid waste disposal sites (SWDSs) is a result of anaerobic decomposition of organic waste by methanogenic bacteria. The amount of methane emitted during the process of decomposition is directly proportional to the fraction of degradable organic carbon (DOC) which is defined as carbon content in different types of organic biodegradable wastes. In Croatia, more than 1.7 million tons of municipal solid waste is produced in 2017 and the average composition of it biodegradable part is: paper (23.19%), textile (3.71%), garden and park waste (5.68 %), food waste (30.93%), wood waste and straw (0.98%), diapers (3.97%) and gum and leather (0.37%). The rest is inert waste. As for the Wastewater treatment and discharge in Croatia, aerobic biological process is used mostly in wastewater treatment. Anaerobic process is applied in some industrial wastewater treatment, which results with CH<sub>4</sub> emissions. Disposal of domestic and commercial wastewater, particularly in rural areas where systems such as septic tanks are used, are partly anaerobic without flaring, which results with CH<sub>4</sub> emissions.

### Nitrous oxide (N<sub>2</sub>O)

The most important sources of N<sub>2</sub>O emissions in Croatia are agricultural activities, nitric acid production, but as well, the N<sub>2</sub>O emissions occur in energy sector and waste management.

In the Agricultural sector, three N<sub>2</sub>O emission sources are determined: direct N<sub>2</sub>O emission from agricultural soils, direct N<sub>2</sub>O emission from livestock farming and indirect N<sub>2</sub>O emission induced by agricultural activities. According to IPCC methodology, the mineral nitrogen, nitrogen from organic fertilizers, amount of nitrogen in fixing crops, amount of nitrogen which is released from crop residue mineralization, soil nitrogen mineralization due to cultivation of histosols and amount of nitrogen from the application of sewage sludge is separately analysed.

In Industrial Processes sector, the N<sub>2</sub>O emission occurs in nitric acid production, which is used as a raw material in nitrogen mineral fertilizers. In the framework of the N<sub>2</sub>O reduction measure analysis, the possibility for application of non-selective catalytic reduction device was considered, whereby the nitric acid production influence on N<sub>2</sub>O emissions would be practically eliminated.

In Energy sector the emission was calculated on the basis of fuel consumption and adequate emission factors (IPCC). The major sources of N<sub>2</sub>O emission in Energy sector is use of three-way catalytic converters in road transport motor vehicles.

N<sub>2</sub>O emission from the Waste sector indirectly occurs from human sewage. It is calculated on the basis of the total number of inhabitants and annual protein consumption per inhabitant. Data on the annual per capita Protein Intake Value were obtained by the FAOSTAT Statistical Database. Extrapolation method has been used for calculation of insufficient data.

### Halogenated carbons (HFC, PFC), SF<sub>6</sub> i NF<sub>3</sub>

Synthetic GHGs include halogenated carbons (HFCs and PFCs) and sulphur hexafluoride (SF<sub>6</sub>). Although on an absolute scale their emissions are not great, due to their high global warming potential (GWP) their contribution to global warming is considerable. MEE is responsible for monitoring of consumption of substitutes and mixture of substitutes for gases that deplete the ozone layer. There is no production of HFCs PFCs, SF<sub>6</sub> and NF<sub>3</sub> in Croatia; therefore, all quantities of these gases are imported. Minor quantities of some substances are exported.

Croatia is an Article 5 country, according to the Montreal protocol, and has a longer period for using CFC, HCFC and halons. Because of that, Croatia started using HFCs 10 years later than other Annex I countries. According to survey carried out among major agents, users and consumers of these gases, information related to consumption of HFCs, PFCs, SF<sub>6</sub> and NF<sub>3</sub> (provided by the MEE) was used for emission calculation.



Other information (e.g. indirect GHGs)

The photochemically active gases, carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>) and non-methane volatile organic compounds (NMVOCs) indirectly contribute to the greenhouse gas effect. These are generally called indirect greenhouse gases or ozone precursors, because they are involved in creation and degradation of ozone which is also one of the greenhouse gases. Sulphur dioxide (SO<sub>2</sub>), as a precursor of sulphate and aerosols, is believed to contribute negatively to the greenhouse effect. Emissions of indirect GHGs have been taken from the draft of emission inventory report 'Republic of Croatia Informative Inventory Report for LRTAP Convention for the Year 2017 Submission to the Convention on Long-range Transboundary Air Pollution'.

Although Parties of the Convention may now choose to report indirect CO<sub>2</sub>, in accordance with paragraph 29 of the UNFCCC Inventory Reporting Guidelines, but Croatia declared not to report indirect CO<sub>2</sub> emissions from the atmospheric oxidation of CH<sub>4</sub>, CO and NMVOCs, or indirect N<sub>2</sub>O emissions arising from sources other than those in the agriculture and LULUCF sectors.

Appendix I shows CTF Table 1 of the common table form.

## 2.2.3. Key categories

According to the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, key categories are those which represent 95% (Tier 1) or 90% (Tier 2) of the total annual emissions in the last reported year or belonging to the total trend, when ranked from contributing the largest to smallest share in annual total and in the trend.

Summary table with the key categories identified for the latest reporting year (by level and trend) on the basis of table 4.4 of volume 1 of the 2006 IPCC Guidelines is provided in Table 2-7.

Table 2-7: Key categories summary table for 2015

IPCC Source Categories		GHG	Criteria for Identification of key category			
1. Energy						
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CO <sub>2</sub>	L1e, L2e	T1e, T2e	L1i	T1i	
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CO <sub>2</sub>	L1e, L2e	T1e, T2e	L1i	T1i, T2i	
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CO <sub>2</sub>	L1e, L2e	T1e, T2e	L1i	T1i	
1.A.2 Fuel combustion - Manufacturing Industries and	CO <sub>2</sub>	L1e	T1e	L1i	T1i	
1.A.2 Fuel combustion - Manufacturing Industries and	CO <sub>2</sub>	L1e, L2e	T1e, T2e	L1i	T1i	
1.A.2 Fuel combustion - Manufacturing Industries and	CO <sub>2</sub>	L1e	T1e, T2e	L1i	T1i, T2i	
1.A.3.b Road Transportation	CO <sub>2</sub>	L1e, L2e	T1e, T2e	L1i, L2i	T1i, T2i	
1.A.3.b Road Transportation	N <sub>2</sub> O	L2e	T2e			
1.A.4 Other Sectors - Biomass	CH <sub>4</sub>	L1e, L2e	T1e, T2e	L1i		
1.A.4 Other Sectors - Biomass	N <sub>2</sub> O	L2e	T2e			
1.A.4 Other Sectors - Gaseous Fuels	CO <sub>2</sub>	L1e, L2e	T1e, T2e	L1i	T1i, T2i	
1.A.4 Other Sectors - Liquid Fuels	CO <sub>2</sub>	L1e, L2e	T1e, T2e	L1i	T1i, T2i	
1.A.4 Other Sectors - Liquid Fuels	N <sub>2</sub> O	L2e				
1.A.4 Other Sectors - Solid Fuels	CO <sub>2</sub>		T1e		T1i	
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CO <sub>2</sub>		T2e		T1i	
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CH <sub>4</sub>		T1e, T2e		T1i, T2i	
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas -	CH <sub>4</sub>	L2e				
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas -	CO <sub>2</sub>	L1e, L2e	T2e	L1i, L2i	T1i, T2i	
2. Industrial Processes and Product Use						
2.A.1 Cement Production	CO <sub>2</sub>	L1e	T1e	L1i	T1i	
2.B.1 Ammonia Production	CO <sub>2</sub>	L1e	T1e	L1i	T1i	
2.B.2 Nitric Acid Production	N <sub>2</sub> O		T1e		T1i	
2.B.8 Petrochemical and Carbon Black Production	CO <sub>2</sub>		T1e		T1i	
2.C.2 Ferroalloys Production	CO <sub>2</sub>		T1e		T1i	
2.C.3 Aluminium Production	CO <sub>2</sub>				T1i	
2.C.3 Aluminium Production	PFCs		T1e		T1i	
2.D Non-energy Products from Fuels and Solvent Use	CO <sub>2</sub>		T1e, T2e		T1i	
2.F.1 Refrigeration and Air conditioning - Aggregate	F-gases	L1e, L2e	T1e, T2e	L1i	T1i, T2i	
2.G Other	N <sub>2</sub> O		T2e			
3. Agriculture						
3.A Enteric Fermentation	CH <sub>4</sub>	L1e, L2e	T1e, T2e	L1i	T1i, T2i	
3.B Manure Management	CH <sub>4</sub>	L1e	T1e	L1i		

IPCC Source Categories	GHG	Criteria for Identification of key category			
3.B Manure Management	N <sub>2</sub> O	L1e	T1e, T2e		T1i
3.D.1 Direct N <sub>2</sub> O Emissions From Managed Soils	N <sub>2</sub> O	L1e, L2e		L1i, L2i	T1i, T2i
3.D.2 Indirect N <sub>2</sub> O Emissions From Managed Soils	N <sub>2</sub> O	L1e, L2e		L1i, L2i	T2i
<b>4. LULUCF</b>					
4(III).Direct N <sub>2</sub> O emissions from N mineralization/immobilization	N <sub>2</sub> O			L2i	T2i
4.A.1 Forest Land Remaining Forest Land	CO <sub>2</sub>			L1i, L2i	T1i, T2i
4.A.2 Land Converted to Forest Land	CO <sub>2</sub>			L1i, L2i	T1i, T2i
4.B.1 Cropland Remaining Cropland	CO <sub>2</sub>			L1i, L2i	T1i, T2i
4.B.2 Land Converted to Cropland	CO <sub>2</sub>			L1i, L2i	T2i
4.C.2 Land Converted to Grassland	CO <sub>2</sub>			L2i	T2i
4.D.2 Land Converted to Wetlands	CO <sub>2</sub>			L1i, L2i	T2i
4.E.2 Land Converted to Settlements	CO <sub>2</sub>				T2i
4.G Harvested Wood Products	CO <sub>2</sub>			L1i, L2i	T1i, T2i
4(III). Direct N <sub>2</sub> O emissions from fertilizing/soil stabilization by	CO <sub>2</sub>			L1i, L2i	T1i, T2i
<b>5. Waste</b>					
5.A Solid Waste Disposal	CH <sub>4</sub>	L1e, L2e	T1e, T2e	L1i, L2i	T1i, T2i
5.D Wastewater Treatment and Discharge	CH <sub>4</sub>	L1e	T1e, T2e	L1i	T1i
5.D Wastewater Treatment and Discharge	N <sub>2</sub> O	L2e	T2e		

L1e – Level excluding LULUCF - Tier1  
 L2e – Level excluding LULUCF - Tier2  
 L1i – Level including LULUCF - Tier1  
 L2i – Level including LULUCF - Tier2

T1e – Trend excluding LULUCF - Tier1  
 T2e – Trend excluding LULUCF - Tier2  
 T1i – Trend including LULUCF - Tier1  
 T2i – Trend including LULUCF - Tier2

## 2.2.4. Uncertainty assessment and verification

The uncertainties associated with both annual estimates of emissions and emission trends over time are reported according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The uncertainties are estimated using Tier 1 and Tier 2 (Monte Carlo analysis) methods described by the IPCC, which provide estimates of uncertainties by pollutant. The uncertainties are estimated for both excluding LULUCF and including LULUCF due to the Good Practice Guidance for Land Use, Land-Use Change and Forestry.

### Uncertainty in the emissions and the trend excluding LULUCF

The estimate of CO<sub>2</sub>-eq emissions in 2017 was estimated at 25,019.75 kt CO<sub>2</sub>-eq. The estimate of CO<sub>2</sub>-eq emissions in 1990 was estimated at 31,858.36 kt CO<sub>2</sub>-eq.

Monte Carlo analysis shows that with a certainty of 95 % it can be stated that the total simulated emissions of all categories excluding LULUCF for the year 2017 (25,392.09 kt CO<sub>2</sub>e) varies between 23,844.47 kt CO<sub>2</sub>-eq (2.5 percentile) and 27,131.51 kt CO<sub>2</sub>-eq (97.5 percentile).

Monte Carlo analysis shows that with a certainty of 95 % it can be stated that the total simulated emissions of all categories excluding LULUCF for the year 1990 (32,483,05 kt CO<sub>2</sub>e) varies between 30,616,17 kt CO<sub>2</sub>-eq (2.5 percentile) and 34,495,95 kt CO<sub>2</sub>-eq (97.5 percentile).

The Inventory trend excluding LULUCF is -21.47%, simulated trend is -21.76% and the 95% probability range of the trend is -28.28 % (2.5 percentile) to -14.69 % (97.5 percentile).

#### Uncertainty in the emissions and the trend including LULUCF

The estimate of CO<sub>2</sub>-eq emissions in 2017 was estimated at 20,253.17 kt CO<sub>2</sub>-eq. The estimate of CO<sub>2</sub>-eq emissions in 1990 was estimated at 25,203.78 kt CO<sub>2</sub>-eq.

Monte Carlo analysis shows that with a certainty of 95 % we can say that the total emissions of categories for the year 2017 (24,710.58 kt CO<sub>2</sub>-eq) according to simulation varies between 17,616.96 kt CO<sub>2</sub>-eq (2.5 percentile) and 31,783.27 kt CO<sub>2</sub>-eq (97.5 percentile).

The Inventory trend including LULUCF is -19.64 %, simulated trend is -14.78 % and the 95% probability range of the trend is -43.07 % (2.5 percentile) to 21.14% (97.5 percentile), so the uncertainty introduced in trend varies from -23.42 % to 40.78 % with respect to the base year emissions.

The results of the uncertainty analysis are used to drive improvements of the inventory. Most efforts were made to collect detailed information on AD and EFs (especially country-specific EFs) in order to improve accuracy of the emission calculation.

#### Verification

The verification process of calculation aims to improve the quality of the input and to identify the reliability of the calculation. The recommendation of the IPCC Guidelines is that the inventory check is performed through a set of simple checks for completeness and accuracy.

In the development of the Croatian inventory, certain steps and some of these checks were performed:

- comparison with the national inventory data of other countries was conducted by comparing CRF tables or through a direct communication;
- comparison of activity data with the use using different sources such as Croatian Bureau of Statistics and individual emission sources;
- the CO<sub>2</sub> emissions from fossil fuel combustion, within the framework of IPCC methodology, are estimated using two approaches: (1) Reference Approach and (2) Sectoral Approach (Tier 1).

## **2.3. INSTITUTIONAL AND ORGANIZATIONAL STRUCTURE FOR THE PREPARATION OF THE NATIONAL INVENTORY OF THE GREENHOUSE GAS EMISSIONS**

### **2.3.1. National system**

The National system for Croatia fulfils the requirements, as set forth by both UNFCCC decisions (Decision 24/CP.19 and Decision 19/CMP.1) and the Regulation No 525/2013 on a

mechanism for monitoring and reporting greenhouse gas emissions in the European Union and its Member States.

Institutional arrangement for inventory preparation in Croatia is regulated in Chapter II of the Regulation on the Monitoring of Greenhouse Gas Emissions, Policies and Mitigation Measures in the Republic of Croatia (OG 5/17). Institutional arrangements for inventory management and preparation in Croatia is decentralized because the services of external associates are used and the powers to perform individual tasks are divided between the cooperating institutions, including MEE and competent governmental bodies responsible for providing of activity data. The preparation of inventory itself is entrusted to Authorised Institution, which is elected for three-year period by public tendering. Committee for Cross-Sectoral Coordination for National System for Monitoring of GHG emission (National System Committee) is included in the approval process. The members of the Committee are appointed by the competent ministries at the request of the MEE and they give an opinion on a part of the inventory within their specialty as well.

Members of the National System Committee are nominated by the authorized Ministries upon the request of the MEE.

MEE is a national focal point for the UNFCCC, with overall responsibility for functioning of the National system in a sustainable manner, including:

- mediation and exchange of data on GHG emissions and removals with international organisations and Parties to the Convention;
- mediation and exchange of data with competent bodies and organisations of the EU in a manner and within the time limits laid down by legal acts of the EU;
- control of methodology for emission calculation and GHG removal in line with good practices and national circumstances;
- consideration and approval of the Greenhouse Gas Inventory Report prior to its formal submission to the Convention Secretariat;
- organisation of GHG inventory preparation with the aim of meeting the deadlines;
- collection of activity data;
- development of quality assurance and quality control plan (QA/QC plan) related to the GHG inventory in line with the guidelines on good practices of the Intergovernmental Panel on Climate Change;
- implementation of the quality assurance procedure with regard to the GHG inventory in line with the quality assurance and quality control plan;
- archiving of activity data on calculation of emissions, emission factors, and of documents used for inventory planning, preparation, quality control and quality assurance;
- maintaining of records and reporting on authorised legal persons participating in the Kyoto Protocol flexible mechanisms;
- selection of Authorised Institution (in Croatian: *Ovlaštenik*) for preparation of the GHG inventory;
- provide insight into data and documents for the purpose of technical reviews.

Authorised Institution is responsible for preparation of inventory, which include:

- emission calculation of all anthropogenic emissions from sources and removals by GHG sinks, and calculation of indirect GHG emissions, in line with the methodology stipulated by the effective guidelines of the Convention, guidelines of the Intergovernmental Panel on Climate Change, Instructions for reporting on GHG emissions as published on the Ministry's website, and on the basis of the activities data;
- quantitative estimate of the calculation uncertainty for each category of source and removal of GHG emissions, as well as for the inventory as a whole, in line with the guidelines of the Intergovernmental Panel on Climate Change;
- identification of key categories of GHG emission sources and removals;
- recalculation of GHG emissions and removals in cases of improvement of methodology, emission factors or activity data, inclusion of new categories of sources and sinks, or application of coordination/adjustment methods;
- calculation of GHG emissions or removal from mandatory and selected activities in the sector of land use, land-use change and forestry;
- reporting on issuance, holding, transfer, acquisition, cancellation and retirement of emission reduction units, certified emission reduction units, assigned amount units and removal units, and carry-over, into the next commitment period, of emission reduction units, certified emission reduction units and assigned amount units, from the Registry in line with the effective decisions and guidelines of the Convention and supporting international treaties;
- implementation of and reporting on quality control procedures in line with the quality control and quality assessment plan;
- preparation of the GHG inventory report, including also all additional requirements in line with the Convention and supporting international treaties and decisions;
- cooperation with the Secretariat's ERTs for the purpose of technical review and assessment/evaluation of the inventory submissions.

EKONERG – Energy and Environmental Protection Institute was selected as Authorised Institution for preparation of inventory submission for the ongoing three year period.

Process of inventory preparation encompasses several steps starting with activity data collection on the basis of the Program of data collection and followed by emissions estimation and recalculations in accordance with the IPCC methodology and recommendations for improvements provided by the expert review team (ERT), compilation of inventory including the National Inventory Report (NIR) and the Common Reporting Format (CRF) tables and in parallel implementation of general and source category specific quality control procedures.

Annual data Collection Plan (ADCP) is main document for data collection which is the responsibility of MEE. It contains source categories, activity, activity data, data source and competent authority and is made for each sector. This document is prepared annually in collaboration between MEE and National System Committee (

Table 2-8).

Table 2-8: Data sources for GHG inventory preparation

CRF Sector/ Sub-sector	Type of data	Source of data
Energy	Energy balance	- MEE with assistance of Energy Institute Hrvoje Požar
	Registered motor vehicles database	- Ministry of Interior
	Fuel consumption and fuel characteristic data for thermal power plants	- Pollution Emission Register - MEE - Verified reports of CO <sub>2</sub> emission - Voluntary survey of Power Utility Company
	Fuel characteristic data	- Voluntary survey of Oil and Gas Company
	Natural gas processed (scrubbed), CO <sub>2</sub> content before scrubbing and CO <sub>2</sub> emission	- Voluntary survey of Central Gas Station
Industrial Processes	Activity data on production/consumption of material for particular industrial process	- CBS, Department of Manufacturing and Mining - MEE - 'Republic of Croatia <i>Informative Inventory Report for LRTAP Convention for the Year 2015</i> Submission to the Convention on Long-range Transboundary Air Pollution'
	Activity data on production/consumption of halogenated hydrocarbons (PFCs, HFCs) and sulphur hexafluoride (SF <sub>6</sub> )	- MEE
	Data on consumption and composition of natural gas in ammonia production Data on cement and lime production	- Survey of ammonia manufacturer - Survey of cement and lime manufacturers - MEE
Solvent and Other Product Use	Activity data on production for particular source category and number of inhabitants	- 'Republic of Croatia <i>Informative Inventory Report for LRTAP Convention for the Year 2015</i> Submission to the Convention on Long-range Transboundary Air Pollution'
Agriculture	Livestock number	- CBS - Croatian Agricultural Agency (CAA)
	Production of N-fixing crops and non N-fixing crops	- CBS
	Area of histosols	- Faculty of Agriculture
	Activity data on mineral fertilisers applied in Croatia	- Voluntary survey of Fertilizer Companies
	Activity data on sewage sludge applied	- Voluntary survey of Food Company
LULUCF	Activity data on areas of different land use categories, annual increment and annual harvest and wildfires	- Ministry of Agriculture with assistance of public company Croatian Forests "Hrvatske šume"

CRF Sector/ Sub-sector	Type of data	Source of data
	Activity data on crop production	- MEE - CBS
Waste	Activity data on municipal solid waste disposed to different types of SWDSs	- MEE
	Activity data on wastewater treatment and discharge	- State company Croatian Water (Hrvatske vode)
	Activity data on waste incineration	- MEE

Activity data collection is under responsibility of MEE which represents a hub between governmental and public institutions responsible for providing activity data and Authorised Institution responsible for inventory preparation. The scope and due dates for delivering activity data to MEE are prescribed by the Regulation on the Monitoring of Greenhouse Gas Emissions, Policies and Mitigation Measures in the Republic of Croatia (OG 5/17).

After activity data are collected and processed, inventory team performed emission estimations and recalculation in accordance with the IPCC methodology and taking into consideration recommendations for inventory improvements. Results are checked against quality control procedures in order to ensure data integrity, correctness and completeness.

According to Article 7. of the Regulation on the Monitoring of Greenhouse Gas Emissions, Policies and Mitigation Measures in the Republic of Croatia, within the competence of MEE is the preparation of quality assurance and quality control plan regarding greenhouse gas inventory (hereinafter QA/QC plan), implementation of the quality assurance procedures in accordance with the QA/QC plan and archiving activity data for emission calculation, emission factors and documents used for planning, preparing, controlling and assuring Inventory quality. QA/QC plan is a part of quality assurance and quality control system (QA/QC system), stipulated by Decision 19/CMP.1 Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol. Implementation of QA/QC system is based on following documents: Annual Data Collection Plan (ADCP), QA/QC Plan, Category-specific QC checklist and Improvement Plan.

QA/QC plan describes overall responsibilities and roles of institutions involved in inventory planning, preparation and management, preparation of timetable of activities for data collection, inventory preparation and submission, annual review and reporting on GHG registry and general and specific QA/QC procedures.

Improvement Plan is document which defines objectives related to the improvement of National Inventory. This document takes into account key category analysis and recommendations outlined in the Annual review report. This document is prepared annually.

Quality control activities are focused on following elements of inventory preparation and submission process:

- Activity data collection and archiving;



- Preparation of inventory report;
- Submission of inventory report;
- Review activities;
- Reporting on GHG registry.

For the purposes of transparency of the emission calculation, inventory team preparation the documentation for archiving of data (Inventory Data Record Sheets, IDRS) which contain details of the person and/or organization responsible for an emission estimate, the primary or secondary sources of activity data and emission factors used, the methodology applied, data gaps, ways to cross-check, suggestion for future improvement in the estimates and relevant bibliographic references. The information provided in IDRS is available for each source category and for the entire time-series. All data in the form of IDRS are also archived at MEE.

During the preparation of the NIR a number of checks were carried out by sector experts related to completeness, consistency, comparability, recalculation and uncertainty of activity data, emission factors and emission estimates. The details on these issues are elaborated in the NIR by each sector, subsector and corresponding CRF tables.

Finally, before the Authorized Institution submits the NIR to MEE, QA/QC manager carried out an audit which covers selected IPCC source categories, as outlined in the QA/QC plan, with purpose to check which quality control elements, both general (Tier 1) and specific (Tier 2), as defined in the IPCC Good Practice Guidance, are already implemented by sector experts and which improvements and corrective actions should be carried out in the future submissions. CRF tables for each sector are reviewed in accordance with the Quality Management Standard (ISO 9001) and Environmental Management Standard (ISO 14001) implemented within the Agency and the authorized institution. Audit results are registered in control lists as well as performed correction activities.

Once complete Inventory and CRF tables are submitted to the MEE, MEE approves them. National System Committee is included in the approval process; its members provide their opinion on certain parts of the Inventory within the frame of their speciality. QA/QC coordinator documents all National System Committee results/findings.

Changes in the national system that occurred since the publication of the third biennial report include the merging of the Croatian Agency for Environment and Nature to the MEE. Namely, in accordance with the Act on Amendments to the Act on Environmental Protection (OG 118/18), the Croatian Agency for Environment and Nature was annexed to the MEE since 1<sup>st</sup> January 2019. In this context, all tasks, legal rights and obligations of the Croatian Agency for Environment and Nature are taken over by the MEE.

### **2.3.2. National registry**

Since June 2012, EU Member States' greenhouse gas registers have been consolidated into one system - EUCR (European Union Consolidated Registry), which is managed and maintained

by the European Commission (EC). The Union registry is linked to the European Transaction Log (EUTL) and the International Transaction Log (ITL).

The Union Registry is a systematized and computerized database in which accounts of greenhouse gas emission trading participants are kept. It records and monitors compliance with the law on the obligations of the installation and aircraft operators, records the transactions and the amounts of the allocated free emission units. The registry ensures accuracy, transparency and public availability of data on the fulfilment of obligations. The functional requirements of the registry are determined by the EC through the Registry regulation and by the UNFCCC Secretariat through various COP/MOP decisions. All publicly available information from the Union Registry can be found on the European Transaction Log (EUTL) website. On January 17<sup>th</sup> 2013 the Croatian GHG register became part of the Union Registry, six months before Croatia became a full member of the EU. Within the unified Union Registry each member state has its own national part of the Registry and a national administrator.

The National Administrator of the Croatian part of the Union Registry is MEE, pursuant to Law on Environmental Protection (OG 130/11, 47/14, 61/17, 118/18). Managing the Croatian part of the Union Registry includes opening and managing ETS accounts, performing transactions on national Kyoto and ESD accounts, producing public reports and publishing information in accordance with international and national regulations.

Information on changes in the Registry, as defined in the NIR 2019, are shown in the Table 2-9.

Table 2-9: Changes in National Registry

Reporting Item	Description
15/CMP.1 annex II.E paragraph 32.(a) Change of name or contact	Removal of national administrator team members: Ms. Grozdana Avirović, e-mail: <a href="mailto:grozdana.avirovic@mzoe.hr">grozdana.avirovic@mzoe.hr</a> Mr. Dino Križnjak, e-mail: <a href="mailto:dino.kriznjak@mzoe.hr">dino.kriznjak@mzoe.hr</a>
15/CMP.1 annex II.E paragraph 32.(b) Change regarding cooperation arrangement	No change of cooperation arrangement occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(c) Change to database structure or the capacity of national registry	The version of the EUCR released after 8.0.8 (the production version at the time of the last Chapter 14 submission) introduced minor changes in the structure of the database. These changes were limited and only affected EU ETS functionality. No change was required to the database and application backup plan or to the disaster recovery plan. The database model is provided in Annex A. This document is considered confidential and is available upon request. No change to the capacity of the national registry occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(d) Change regarding conformance to technical standards	Changes introduced since version 8.0.8 of the national registry are listed in Annex B. This document is considered confidential and is available upon request. Each release of the registry is subject to both regression testing and tests related to new functionality. These tests

Reporting Item	Description
	also include thorough testing against the DES and were successfully carried out prior to the relevant major release of the version to Production (see Annex B). No other change in the registry's conformance to the technical standards occurred for the reported period.
15/CMP.1 annex II.E paragraph 32.(e) Change to discrepancies procedures	No change of discrepancies procedures occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(f) Change regarding security	No changes regarding security occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(g) Change to list of publicly available information	No change to the list of publicly available information occurred during the reporting period.
15/CMP.1 annex II.E paragraph 32.(h) Change of Internet address	The internet address changed during the reported period. The new URL is <a href="https://unionregistry.ec.europa.eu/euregistry/HR/index.xhtml">https://unionregistry.ec.europa.eu/euregistry/HR/index.xhtml</a>
15/CMP.1 annex II.E paragraph 32.(i) Change regarding data integrity measures	No change of data integrity measures occurred during the reporting period.
15/CMP.1 annex II.E paragraph 32.(j) Change regarding test results	Changes introduced since version 8.0.8 of the national registry are listed in Annex B. This document is considered confidential and is available upon request. Both regression testing and tests of the new functionality were successfully carried out prior to release of the version to Production. The site acceptance test was carried out by quality assurance consultants on behalf of and assisted by the European Commission.
1/CMP.8 paragraph 23 PPSR account	Previous period surplus reserve (PPSR) account will be established in the Consolidated System of European Registries (CSEUR).
The Annexes A and B are considered as confidential and are available upon request.	

### 3. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

#### 3.1. THE EU TARGET UNDER THE CONVENTION

This section explains the EU 2020 emission reduction target under the Convention and the target compliance architecture set up within the EU in order to meet that target, and gives an overview of the emission reduction targets of the Republic of Croatia in the context of the EU emission target.

In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20 % compared to 1990 levels, in order to contribute to achieving the ultimate objective of the Convention: 'to stabilise GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate system'<sup>4</sup>, or, in other words, to limit the global temperature

<sup>4</sup> First steps to a safer future: Introducing the United Nations Framework Convention on Climate Change <http://unfccc.int/essential/background/convention/items/6036.php>

increase to less than 2°C compared to temperature levels before industrialization (FCCC/CP/2010/7/Add.1).

The EU clarified that the accounting rules for the target under the UNFCCC are more ambitious than the current rules under the Kyoto Protocol, for example, including international aviation, adding an annual compliance cycle for emissions under the Effort Sharing Decision (ESD, Decision No 406/2009/EC on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020) or higher Clean Development Mechanism (CDM) quality standards under the EU Emissions Trading System (EU ETS) (FCCC/TP/2013/7).

The following assumptions and conditions apply to the EU's 20 % target under the Convention:

- Emissions/removals from LULUCF are not included but it is estimated to be a net sink over the relevant period. EU inventories also include information on emissions and removals from LULUCF in accordance with relevant reporting commitments under the Convention. Accounting for LULUCF activities only takes place under the Kyoto Protocol.
- The target refers to 1990 as a single base year for all gases and all Member States.
- Emissions from international aviation to the extent it is included in the EU ETS are included in the target.<sup>5</sup>
- A limited number of CERs and ERUs units may be used to achieve the target in the ETS, the use of international credits is limited (for Croatia up to 4.5% of the emission reductions required within the EU ETS by 2020 and 1.5% for aviation sector). Quality standards also apply to the use of international credits in the EU ETS, including a ban on credits from LULUCF projects and certain industrial gas projects. For the part of emissions outside the EU ETS, the use of international credits is limited to 3% of emissions outside the EU ETS in 2005 for each Member State.
- The Global Warming Potentials (GWPs) used to aggregate GHG emissions up to 2020 under EU legislation were those based on the Second Assessment Report of the IPCC when the target was submitted. For the implementation until 2020, GWPs from IPCC Fourth Assessment Report (AR4) are used in accordance with GHG emission inventory reporting guidelines.
- The target covers the gases CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>.

Key facts about the EU objective under the Convention are summarized in Table 3-1.

Table 3-1: Key facts of the Convention target of the EU-28

Parameters	Target
Base Year	1990
Target Year	2020
Emission Reduction target	-20% in 2020 compared to 1990

<sup>5</sup> In the EU, emissions covered by category 'international aviation' go beyond the scope of the EU target, as emissions from international aviation are included in the EU Climate and Energy Package and the EU target under the UNFCCC to the extent to which aviation is part of the EU ETS. As such emissions cannot be separated in the EU inventory nor in the projections for the entire time series, emissions from international aviation have been considered in their entirety throughout the report. Over the period, total emissions from international aviation were between 1.2-2.9% of the annual total EU GHG emissions.

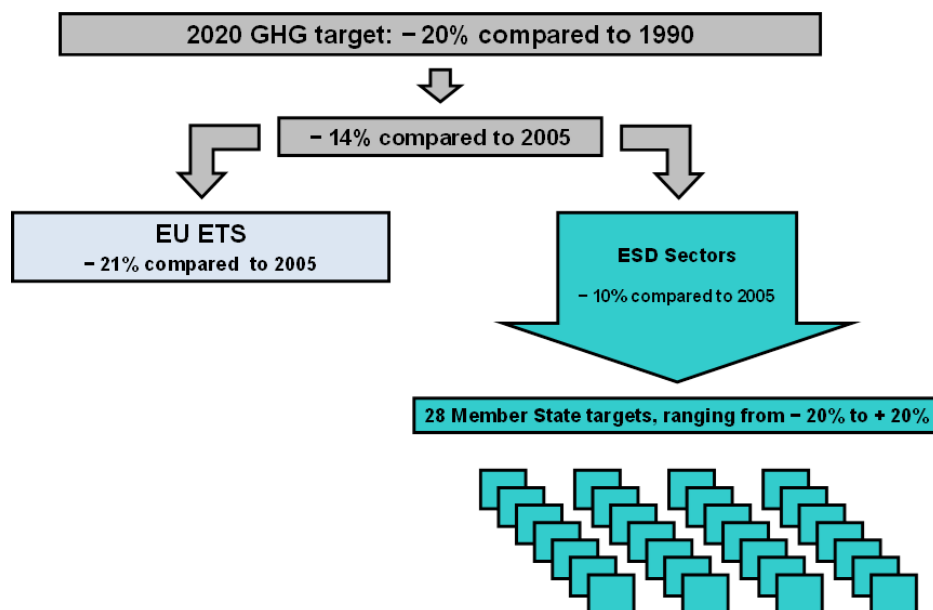
Parameters	Target
Gases covered	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub>
Global Warming Potential	AR4
Sectors Covered	All IPCC sources and sectors, as measured by the full annual inventory and international aviation to the extent it is included in the EU ETS.
Land Use, Land-Use Change, and Forests (LULUCF)	Accounted under KP, reported in EU inventories under the Convention. Assumed to produce net removals
Use of international credits (JI and CDM)	Possible subject to quantitative and qualitative limits.

As this target under the Convention has only been submitted by EU-28 and not by each of its Member States (MS), there are no specified Convention targets for single MS. Due to this, Croatia as part of the EU-28, takes on a quantified economy-wide emission reduction target jointly with all Member States.

In 2009 the EU established internal rules under its “2020 climate and energy package”<sup>6</sup> - these underpin the EU implementation of the target under the Convention. The package introduced a clear approach to achieving the 20 % reduction of total GHG emissions from 1990 levels, which is equivalent to a 14 % reduction compared to 2005 levels. This 14 % reduction objective is divided between the ETS and ESD sectors. These two sub-targets are:

- a 21 % reduction target compared to 2005 for emissions covered by the ETS (including domestic and international aviation);
- a 10 % reduction target compared to 2005 for ESD sectors, shared between the 28 Member States (MS) through individual national GHG targets.

The distribution of the total target across the ETS and ESD is shown in the Figure 3-1.



6

[http://ec.europa.eu/clima/policies/package/index\\_en.htm](http://ec.europa.eu/clima/policies/package/index_en.htm)

Figure 3-1: Targets to reduce greenhouse gas emissions under the 2020 climate and energy package

Under the revised EU ETS Directive (Directive 2009/29/EC), a single ETS cap covers the EU Member States and three participating non-EU countries (Norway, Iceland and Liechtenstein), i.e. there are no further individual caps by country. Allowances allocated in the EU ETS from 2013 to 2020 decrease by 1.74 % annually, starting from the average level of allowances issued by Member States for the second trading period (2008–2012).

The three non-EU countries participating in EU ETS (Norway, Iceland and Liechtenstein) are also subject to a similarly defined cap and the same annual decrease in allowance allocation.

The vast majority of emissions within the EU which fall outside the scope of the EU ETS are addressed under the Effort Sharing Decision (ESD) (Decision No 406/2009/EC). The ESD covers emissions from all sources outside the EU ETS, except for emissions from domestic and international aviation (which were included in the EU ETS from 1 January 2012), international maritime, and emissions and removals from land use, land-use change and forestry (LULUCF). Sectors outside the EU ETS include a diverse range of small-scale emitters in a wide range of sectors: transport, buildings, services, small industrial plants, fugitive emissions from the energy sector, emissions of fluorinated gases from appliances and other sources, agriculture and waste. Such sources currently account for about 60 % of total GHG emissions in the EU.

While the EU ETS target is to be achieved by the EU as a whole, the ESD target was divided into national targets to be achieved individually by each Member State. Under the Effort Sharing Decision, national emission targets for 2020 are set, expressed as percentage changes from 2005 levels. These changes have been transferred into binding quantified annual reduction targets for the period from 2013 to 2020 (Commission Decisions 2013/162/EU and 2013/634/EU), denominated in Annual Emission Allocations (AEAs). At country level, 2020 targets under the ESD range from -20 % to +20 %, compared to 2005 levels. ESD targets for 2020 for each EU Member State are shown in the Figure 2-2. The target levels have been set on the basis of Member States' relative Gross Domestic Product per capita. In addition, different levels of development in the EU-28 are taken into account by the provision of several flexibility options.

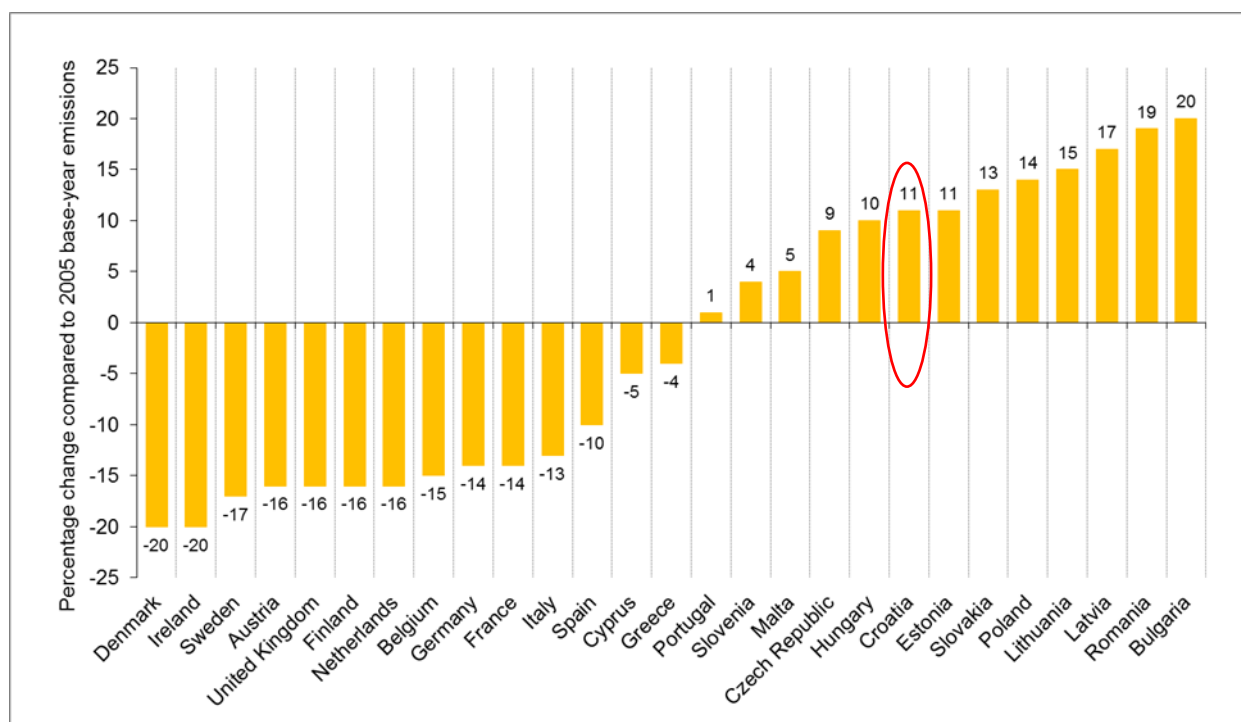


Figure 3-2: National 2020 GHG emission limits under the ESD, relative to 2005 emissions levels

Up to certain limitations, the ESD allows Member States (MS) to make use of flexibility provisions for meeting their annual targets: carry-over of over-achievements to subsequent years within each Member State up to 5%, transfers of AEAs between Member States and the use of international credits (credits from Joint Implementation and the Clean Development Mechanism) up to 3% according to the Decision No 406/2009/EC. Nevertheless, ESD targets are designed in a strict manner. The ESD and the Regulation No 525/2013 have introduced an annual compliance cycle requiring a review of Member States' greenhouse gas inventories to ensure compliance with their obligations under the ESD in the period from 2013 to 2020. Monitoring, reporting and verification of the ESD targets mainly takes place through the submission of the national GHG inventories by Member States. Every year, once MS emissions are reviewed according to strict criteria (described in Chapter III of the Commission Implementing Regulation 749/2014), the European Commission issues an implementing decision on MS ESD emissions in the given year. MS exceeding their annual AEA, even after taking into account the flexibility provisions and the use of JI/CDM credits, will face inter alia a penalty – a deduction from their emission allocation of the following year (excess emissions, multiplied by 1.08).

The difference between the emissions and the Kyoto Protocol target for the period from 2008 to 2012 period is presented in

Table 3-2, using the GWP value from the IPCC 2<sup>nd</sup> Assessment Report.

Table 3-2: Difference to Kyoto target (kt CO<sub>2</sub> eq)

	1990	2008	2009	2010	2011	2012	2008 -2012
Total emissions		31.376	29.341	28.806	28.464	26.385	144.373
Total emissions + removal**		30.404	28.369	27.834	27.492	25.413	139.513
Base year emission	31.322						
TARGET: -5% compared to the base year		29.756	29.756	29.756	29.756	29.756	148.780*
Total emission difference		1.620	-415	-950	-1.292	-3.371	-4.407
Total emission difference + removal**		648	-1.387	-1.922	-2.264	-4.343	-9.267

\* Assigned amount calculated in the manner prescribed by Article 3, paragraphs 7 and 8 of the Kyoto Protocol

\*\* Removal included in amount of 972 kt CO<sub>2</sub>e per year

Table 3-2 shows the limitation of greenhouse gas emissions in the ESD sector for the period from 2013 to 2020, using the GWP values from the 4<sup>th</sup> IPCC assessment reports.

Table 3-3: Annual quota amount for Croatia for the period 2013 – 2020 (kt CO<sub>2</sub>-eq)

	2013	2014	2015	2016	2017	2018	2019	2020
Annual allowance allocation	19,614	19,805	19,997	20,188	18,681	18,893	19,106	19,318

Further information can be found in Annex I - CTF Tables 2 (a) - (f).



## **4. PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS AND RELEVANT INFORMATION**

### **4.1. INTRODUCTION**

#### **4.1.1. General and development policy**

In 2017, the Law on the System of Strategic Planning and Management of the Development of the Republic of Croatia (OG 123/17) was adopted. This Law regulates the system of strategic planning of the Republic of Croatia and the management of public policies, i.e. the preparation, development, implementation, reporting, monitoring of implementation and impacts and evaluation of strategic planning documents for the design and implementation of public policies which, in accordance with their competencies, authorities create.

The National Development Strategy is the highest hierarchical document. Subsequently, there are several sector and sector strategies, then plans and programs. It is currently drafting the first National Development Strategy of the Republic of Croatia until 2030, the plan is to be adopted by 2020<sup>7</sup>. Currently, the strategic development of the Republic of Croatia is based on a series of multi-sectorial and sectorial strategies, plans and programs.

As an important current document defining development policy by 2020, the Government Program of the Republic of Croatia for the mandate of 2016-2020<sup>8</sup>. The main goals are:

- achieving a stable and lasting economic growth;
- creation of new and quality jobs;
- stopping emigration of the population and demographic renewal;
- social justice and solidarity.

In the field of ecology, sustainable development and environmental protection, the following specific objectives are:

- protection of Croatian natural resources;
- integrated water management and protection of national water resources;
- adaptation to climatic change;
- efficient waste management.

In the field of energy, the following specific objectives are:

- improving the security of oil supply in Croatia and the EU;
- improving the security of gas supply in Croatia and the EU.

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<sup>7</sup> Croatia 2030, Ministry of Regional Development and European Union Funds, 2018, Available: <http://www.hrvatska2030.hr/>

<sup>8</sup> Program of the Government of the Republic of Croatia for the mandate 2016 - 2020, Government of the Republic of Croatia, Zagreb, 2016

#### **4.1.2. Environmental protection policy in the context of climate change mitigation**

The MEE is responsible for the overall national environmental policy, including climate change. MEE performs the organization of greenhouse gas inventory creation, reports on the implementation of policies and measures to reduce emissions and increase greenhouse gas removals, and report on projections of greenhouse gas emissions by source and their removals; prepares data on the quantities of verified greenhouse gas emissions from plants covered by the Emissions Trading Scheme; conducts checks on the consistency of data on activities and emissions of greenhouse gases and indirect greenhouse gases by comparison with verified emissions; reports on the issuance, account holding, transfer, receipt, cancellation and withdrawal of emission reduction units, certified emission reductions units, allowance allocation and units removal and transfer of the units to the next binding period, from the Union Register; maintains records and reporting of authorized entities involved in emissions trading, joint venture and clean development measures.

In order to enhance cross-sectoral cooperation, two committees have been set up:

- Commission for Cross-sectoral Coordination for the National GHG Emissions Monitoring System and
- Commission for Cross-sectoral Coordination for Policies and Measures for Climate Change Mitigation and Adaptation.

Commission for Cross-sectoral Coordination for Policies and Measures for Climate Change Mitigation and Adaptation is responsible for monitoring and evaluating the implementation and planning of climate change mitigation and adaptation policies and measures in the Republic of Croatia. Representatives of the competent state administration bodies and other relevant institutions, agencies and non-governmental organizations were appointed to the Commission. The work of the Commission is carried out through the work of the Coordination Group and two technical working groups. The Coordination Group, on the basis of the opinions and proposals of technical working groups, makes recommendations to the Government of the Republic of Croatia on overall policies and measures to mitigate and adapt to climate change; provides support for the implementation of policies and measures for climate change mitigation and adaptation, and evaluates and proposes to the Government the adoption of strategic policy documents and mitigation and adaptation measures.

The establishment of both Commissions has contributed to great progress, improved information flow and sectoral involvement in decision-making, and raised the level of knowledge.

The Republic of Croatia is in the process of adopting a Low Carbon Development Strategy by 2030 with a view to 2050<sup>9</sup>. It is a multi-sectorial development strategy and a base for emission reduction by sectors in line with European strategic guidelines and Convention commitments. Low-carbon Development Strategy should provide the basis for policy decisions and guidelines that all sectors will have to implement in order to significantly reduce greenhouse gas

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<sup>9</sup> Low carbon development strategy of the Republic of Croatia until 2030 with a view to 2050, Draft, Ministry of Environment and Energy, Zagreb, 2019

emissions. This Strategy should provide a transition towards a low-carbon and competitive economy whose growth is based on sustainable development. The Strategy has gone through public consultations but has not yet been adopted.

## **4.2. CROSS-CUTTING POLICIES AND MEASURES**

This section focuses on the key cross-cutting policies and measures, that establish the emissions cap at the Union level, namely the EU Emissions Trading System and the Effort Sharing Decision. It then goes on to look at some key cross-cutting funding mechanisms, such as Horizon 2020 and the European Structural and Investment Funds.

### **4.2.1. The EU Emissions Trading System (EU ETS)**

The EU ETS is based on the 'cap and trade' principle, and has been operational since 2005. It limits emissions from nearly 11,000 heavy energy-using installations (power stations and industrial plants) and over 500 aircraft operators operating between EEA countries, and covers around 40% of the EU's greenhouse gas emissions.

Putting a price on greenhouse gas emissions is important to harness market forces and achieve cost-effective emission reductions. In parallel to providing a carbon price which incentivises emission reductions, in its third trading period the EU ETS supports the reduction of greenhouse gas emissions through providing €2.1bn for the deployment of innovative renewables and carbon capture and storage, via the sale of 300 million emission allowances from the New Entrants' Reserve (the so called NER 300 programme).

The emission reduction obligation of the EU Member State is jointly implemented through the European Emission Trading System (EU ETS). A common 'cap' was established for the EU ETS system, in which 52 facilities from Croatia are also included. The emissions and sectors not covered by the EU ETS, the annual national allocation quotas are determined for the Member States and they must not be exceeded. These quotas are established on the basis of solidarity. According to Regulation (EU 2018/842) on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris agreement for the Republic of Croatia the goal of reducing emissions by 7% compared to the 2005 level is determined. In November 2018 the Commission presented its strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy by 2050. - A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (COM (2018) 773) with a view to achieving climate neutrality in 2050 by the EU.

Between 2013 and 2018, emissions in the sectors covered by the EU ETS have decreased by 15.2%. To increase the pace of emissions cuts in phase 4, the overall number of emission allowances will decline at an annual rate of 2.2% from 2021 onwards, compared to 1.74% during the period between 2013-2020. This increase implies a steady reduction of some 48 million allowances annually, compared to 38 million currently, and is consistent with a 43% reduction in GHG emissions from ETS covered sectors by 2030, compared to 2005 levels.

The Market Stability Reserve (MSR), a mechanism set in place for reducing the imbalance on the carbon market, has been substantially reinforced by the revision. Between 2019 and 2023, the rate at which allowances will be placed in the MSR will be doubled to 24% in order to restore the balance of emission allowances in the carbon market more swiftly. Moreover, from 2023 onwards the number of emission allowances held in the MSR will be limited to the auction volume of the previous year.

#### **4.2.2 The Effort Sharing Decision (2013-2020), Effort Sharing Regulation and LULUCF Regulation (2021-2030)**

The **Effort Sharing Decision** (Decision 406/2009 / EC ESD) covers direct emissions from the non-ETS sectors such as buildings, transport (excluding aviation) and agriculture (excluding land use, land use change and forestry) for the period 2013-2020. It sets binding national emission targets for 2020, expressed as percentage changes from 2005 levels, and a trajectory of annual limits between 2013 and 2020 for each Member State. By 2020, these national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered compared with 2005 levels. Under the decision, EU Member States report annually their greenhouse gas emissions for the period 2013-2020. The EC verifies the emissions and checks that they are within Member States' annual limits (so-called annual emission allocations, AEAs). The next annual compliance check for the year 2018 will be carried out in 2020.

Changes made since the publication of the 3BR include the Effort Sharing Regulation on binding annual emission reductions by Member States for the period from 2021 to 2030 (Regulation (EU) 2018/842) and the LULUCF Regulation (Regulation (EU) 2018/841) adopted in 2018 as part of the EU strategy for the implementation of the Paris Agreement.

The Effort Sharing Regulation sets national emission reduction targets for 2030 ranging from 0% to -40% relative to 2005 emission levels and annual emission limits for 2021 to 2030 for all Member States.

LULUCF Regulation brings new opportunities and defines for the first time an EU target for the LULUCF sector, the so-called "no-debit rule". Member States can use in total up to 280 million tons LULUCF credits in order to comply with the ESD Decision and the Effort Sharing Regulation and can use Effort Sharing AEAs to cover LULUCF debits.

#### **4.2.3. Other measures at EU level**

To respond to challenges and investment needs related to climate change, the EU has agreed that at least 20% of its budget for 2014-2020 – as much as € 180 billion – should be spent on climate change-related action. To achieve this increase, mitigation and adaptation actions are integrated into all major EU spending programmes. The key developments in cross cutting funding policies are summarised in the following sections.

Climate change mitigation and adaptation receives significant support from European Structural and Investment Funds (ESI) amounting to more than EUR 114 billion of which almost half – about EUR 57 billion – comes from the European Agricultural Fund for Rural Development (EAFRD). The European Regional Development Fund (ERDF) and the Cohesion Fund also have a significant contribution of about EUR 55 billion collectively.

Horizon 2020 is the biggest EU Research and Innovation (R&I) programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020), in addition to private and national domestic investment. The EU aims to spend 35% of the overall Horizon 2020 budget on climate relevant R&I. Horizon Europe is the program following Horizon 2020 beyond 2020. The new program covers the period from 2021 to 2027. It will be built on the achievements of Horizon 2020 with a stronger focus on achieving results in the fields of medicine, food and climate change. The budget for the seven-year period is 97.6 billion euros.

The EC channels the support to local authorities mainly through its EU Covenant of Mayors for Climate and Energy initiative. Today, the EU Covenant brings together more than 9,000 cities and towns in all the 28 EU countries taking voluntary action on mitigation and adaptation to climate change as well as on energy poverty. EU Covenant cities contribute to EU's climate and energy objectives with their obligation to reduce emissions.

In November 2018, EC presented its 2050 long-term strategy which outlines a vision of the deep economic and societal transformations required, engaging all sectors of the economy and society, to achieve the transition to a climate-neutral economy. It does not set targets or propose new initiatives to be taken. Instead it seeks to ensure that this transition is socially fair – not leaving Europeans or regions behind – and enhances the competitiveness of EU economy and industry on global markets, securing high quality jobs and sustainable growth in Europe. The EC's vision for a climate-neutral future covers nearly all EU policies and is in line with the Paris Agreement objective to keep temperature increase to well below 2°C, and pursue efforts to keep it to 1.5°C.

### **4.3. SECTORAL POLICIES AND MEASURES**

Policies and measures to reduce emissions from sources and increase sinks of greenhouse gases are shown separately for the following sectors:

- energy
- transport
- industrial processes and product use
- agriculture
- land use, land use change and forestry (LULUCF)
- waste
- other (cross-cutting) policies and measures.

### 4.3.1. Energy

The overview of the strategic and planning framework for reduction of emissions in the energy sector is shown in the Figure 4-1.

The important currently actual strategies and plans include Long-Term Strategy for Mobilising Investment in the Renovation of the National Building Stock of the Republic of Croatia (OG 74/14 ), Plan for protection of air, ozone layer and climate change mitigation in the Republic of Croatia for the period from 2013 to 2017 (OG 139/13), National Renewable Energy Action Plan until 2020, 4th National Energy Efficiency Action Plan for the Period until 2019, Program for the Energy Efficiency in Heating and Cooling, Plan for the use of Funds from the Sale of Emission Allowances in the Republic of Croatia for the Period until 2020 (OG 19/18), set of national programs and plans for the renovation of existing buildings and increase of nearly-zero energy buildings (described later) and national Operational programs for the use of EU Funds.

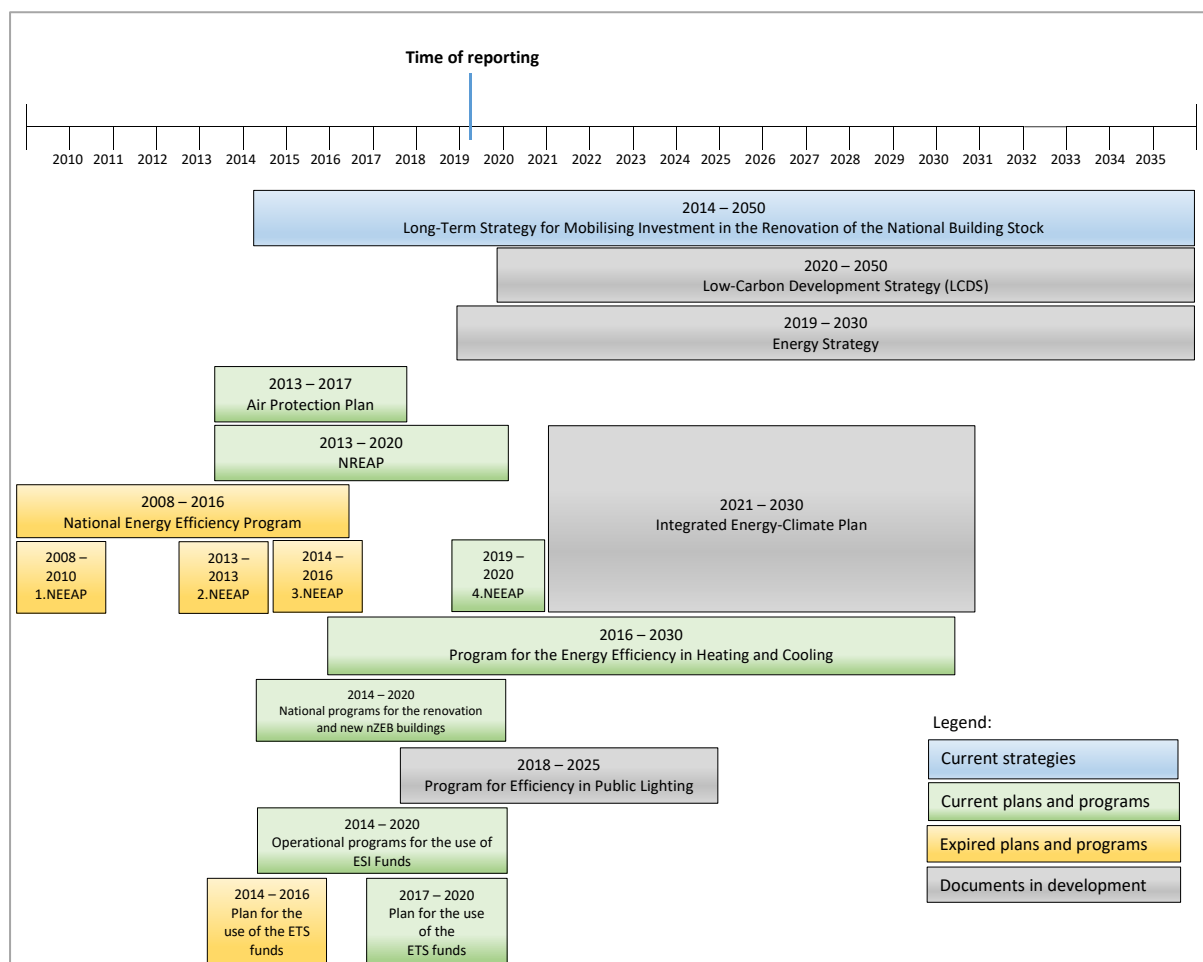


Figure 4-1: Overview of the strategical and planning framework for reduction of GHG emissions in the energy sector

Planning periods of some of the existing plans have expired, but very important policy documents are either available in draft versions or in the process of development. Among them

are Energy Strategy, Integrated National Energy and Climate Plan of the Republic of Croatia for the period from 2021 to 2030, Low-Carbon Development Strategy until 2030 with a view to 2050.

The measures described below are taken from the above documents.

#### MEN-1: National Plan for the Increase of the Number of Nearly-Zero Energy Buildings

After 31<sup>st</sup> December 2020 all new buildings have to be build according to nearly zero energy (nZEB) standard for buildings, and all new buildings in which are owned or used by the public bodies should be built according to the nZEB standard after 31<sup>st</sup> December 2018. The above legal regulations ensure that all newly constructed buildings from 2021 onwards are in the nZEB standard. However, in order to ensure the correct application of these regulations as well as to encourage energy renovation of buildings to the nZEB standard, a number of information and educational activities are planned in the next period to promote the construction and renovation of the nZEB standard.

#### MEN-2: Program for energy renovation of the apartment buildings

This measure foresees the continuation for the implementation of The Program of Energy Renovation of Apartment Buildings for the Period from 2014 to 2020. For this purpose, it is necessary to plan ESI funds for the next programming period 2021-2027 (with implementation by 2030). Implementation procedures need to be significantly facilitated, especially in the area of public procurement implementation. The technical conditions should also remain as in the existing Program, therefore, it is necessary to achieve at least 50% reduction of the building's thermal needs. Upgrades to the nZEB standard need to be strongly encouraged. In addition, consideration should be given to setting up a special fund from which the costs will be reimbursed to energy-poor or at-risk-of-poverty households, to remove the barrier to securing sufficient co-ownership for energy renewal. The implementation of the Program must be accompanied by strong promotional activities, assured technical assistance to applicants, and it is necessary to ensure that energy consumption is monitored before and after energy renewal, which requires the creation of prerequisites under ISGE. It is envisaged to renovate about 520,000 m<sup>2</sup> of apartment buildings per year.

#### MEN-3: Program for the Energy Renovation of the Family Dwellings

The program needs to be conceptualized as a continuation of the implementation of the Energy Efficiency Program for single-family homes from 2014 to 2020, with co-financing from the funds of the Environmental Protection and Energy Efficiency Fund. The primary sources of co-financing should be revenues from the auctioning of greenhouse gas emission units and revenues from the fees paid by suppliers in the energy efficiency obligation system in the event of default. The program should leave the possibility of implementing individual measures, but taking into account the order of implementation of the measures (eg the replacement of the heating system by a more efficient system using RES should only be allowed to those houses that have good thermal characteristics and do not need envelopes). Upgrades to the nZEB standard need to be strongly encouraged. The implementation of the Program must be

accompanied by strong promotional activities. About 350,000 m<sup>2</sup> of single-family homes are planned to be renovated annually.

#### MEN-4: Program for the energy renovation of public buildings

The measure represents a continuation of the implementation of the Energy Sector Building Renovation Program from 2016 to 2020. To this end, it is necessary to plan ESI funds for the next programming period 2021-2027 (with implementation by 2030). The funds should be planned to ensure the activation of private capital and the ESCO market, especially for buildings that are suitable for such financing models (continuous work buildings, such as hospitals, penitentiaries, nursing homes, etc.) and belonging to the category of central government buildings for which there is a binding renovation objective defined in Directive 2012/27 / EU on energy efficiency. Market models should be combined with grants to achieve the nZEB standard. In addition to ESI funds, the EPEEF is also required to plan funds for this Program in the part related to the co-financing of energy renovation of central government buildings under the ESCO model. For buildings that are not suitable for market models, it is necessary to provide grants under the same conditions as in the previous program. Renovation of public sector buildings must be directed to the nZEB standard wherever technically feasible. About 350,000 m<sup>2</sup> of public buildings are planned to be renovated annually.

#### MEN-5: Energy renovation program for buildings that have the status of a cultural property

Protected buildings within the meaning of the Energy Restoration Program for buildings with the status of cultural property are those that can be classified into two categories: individually protected cultural property (individual building and architectural complexes) and buildings within a protected cultural and historical entity. The program does not cover buildings protected as a preventively protected cultural property, nor buildings as a registered cultural property. The Program has developed two basic approaches to the energy renovation of buildings that are the subject of this Program: a holistic (integral) approach and an approach with the application of individual energy renovation measures.

#### MEN-6: Public lighting energy renewal program

The energy renovation of public lighting in the Republic of Croatia is currently being carried out using ESI funds from the European Regional Development Fund, using the favorable interest rate loan facility offered by HBOR (JLP (R) S). A total of HRK 152 million is available for this purpose and the loan covers up to 100% of the eligible project costs. It is anticipated that this financial allocation will be utilized by 2020 and by 2023 at the latest. The estimated savings of this first phase of the Program are about 15 GWh in 2020 (2023). Given the significant potential that exists in public lighting systems, it is planned to use ESI funds in the next programming period 2021-2027. By programming a larger allocation of funds for this purpose, existing potential could be utilized by the end of 2030, estimated at around 225 - 280 GWh. At the same time, the renovation of public lighting would meet the technical standards for the illumination of roads, which would improve transport safety and reduce light pollution.

#### MEN-7: Systematic energy management in the public sector



The public sector in Croatia is obliged to systematically manage energy, which is specifically prescribed by the Energy Efficiency Act and the Regulation on Systematic Energy Management (OG 18/15, 06/16). The basis of the measure is the Energy Management Information System. The goal is to cover and regularly monitor all public sector buildings and public lighting systems by the end of 2030.

#### MEN-8: Energy management system in the business (service & production) sector

Although large companies are obliged to carry out energy audits on a regular basis, this obligation does not ensure continuous care for energy consumption in the enterprise nor does it cover small and medium-sized enterprises. In order to encourage businesses to introduce certified energy management systems (such as ISO 50001), a comprehensive analysis of the possibilities of using the tax system (including taxes and para-fiscal levies) will be developed by 2020 to encourage businesses to introduce such a system and thereby ensure continued care energy consumption.

#### MEN-9: Information Accounts

One of the basic consumer information measures is a legal obligation for suppliers to provide consumers with information bills containing energy billing and end-customer prior consumption data for billing metrics subject to a contractual relationship, which include comparison with the average common or reference end customer from the same category of supplier end customers. It is desirable that the frequency of application of this legal provision is from an annual level of awareness to a monthly level and it is absolutely essential to ensure that the Energy Regulatory Authority (HERA) supervises these obligations of the energy supplier. In addition, on the basis of these regulatory provisions, it is also necessary to further inform consumers about the content and meaning of the bill, which is the task of the National Energy Efficiency Coordination Body.

#### MEN-10: Information on energy efficiency

Information will be provided to the general public and target groups through the organization of targeted info-campaigns related to specific programs for promoting energy efficiency, in particular energy renovation of buildings. The NKT will maintain a national energy efficiency portal and, through the provision of up-to-date information, ensure the continued promotion of energy efficiency and energy services. Particular attention will have to be paid in the coming period to informing the consumer of the duties of the supplier under the obligation system.

#### MEN-11: Energy efficiency education

Training will be achieved by continuing to implement the existing measure and adapting the activity to the needs and the real situation. It is especially important to work systematically to attract young people to the construction and other technical professions, which will in the long run contribute to the availability of expert capacities for the implementation of energy renovation of buildings, which is the basis for achieving the set energy-climate goals. Through

the education in the field of energy efficiency, the principles of green building will be set and applied: the promotion and implementation of green building (building on the principles of sustainability) as an essential segment of sustainable development and the circular economy should be encouraged.

#### MEN-12: Energy efficiency of the electricity transmission system

Current levels of losses in the transmission network of the Republic of Croatia amount to about 2% of the transmitted electricity, which is the amount at the level of other operators of the transmission system ENTSO-E. An important feature of the Croatian transmission network, both in terms of plant safety and support of market activities, as well as in terms of losses, is its extremely strong connection with neighboring power systems (interconnections). While, on the one hand, this significantly increases the security of the drive, on the other hand, the transit increases the network losses. HOPS will continue to implement measures related to the operation of the EES plant and measures related to the development of the transmission network until 2030, with the aim of further reducing technical losses in the network. For this measure, it is proposed, in addition to securing funding from HOPS, to program the use of ESI funds in the next programming period from 2021 to 2027.

#### MEN-13: Reducing losses in the electricity distribution network and introducing advanced networks

HEP-ODS will continue to carry out activities to reduce technical and non-technical losses in the distribution electricity grid until 2030. A detailed analysis will identify the causes of increased losses in some parts of the network and the priorities for implementing activities to reduce technical and non-technical losses. Based on the experience of implementing the pilot project of introducing advanced networks in pilot areas using ESI funds, it is necessary to program the continued use of ESI funds in the next programming period from 2021 to 2027 for the further development of advanced networks.

#### MEN-14: Increasing the efficiency of the heating system

In the existing large district heating systems, a large source of losses is the dilapidated distribution network and this measure foresees the continuation of the replacement of pipelines and steam pipelines with the dilapidated insulation of steel pipelines with new pre-insulated pipes and technological shift towards the fourth generation of district heating. In smaller systems with own boiler rooms, it is necessary to enable the reconstruction of boiler rooms, in particular by replacing high-efficiency cogeneration systems or systems using heat pumps. The measure also envisages the development of new heating and cooling systems, which use high-efficiency cogeneration or renewable energy sources. In view of the provisions of Directive 2018/2002 on energy efficiency, and in particular with the introduction of the obligation of individual measurement at the end-user level, district heating systems have become systems with variable heat demand, which requires the introduction of advanced metering systems as an additional step towards the integration of different energy systems and increasing overall energy efficiency.

#### MEN-15: Increasing the efficiency of the gas system

The potential for increasing the energy efficiency of the gas transmission system is the largest in the consumption of natural gas, which is mostly (70%) consumed for preheating of natural gas before delivery to customers, and only a smaller part (30%) for heating of business premises and various technological burdens, ie blowing out the system. In the coming period, Plinacro will carry out energy efficiency improvement activities in accordance with the Ten-Year Plan for the Development of the Croatian Gas Transmission System 2018-2027.

#### MEN-16: Information, education and capacity building for the use of renewable energy sources

Informing will be provided to the general public and target groups through the organization of targeted information campaigns related to investing in systems that use renewable energy sources, especially in systems intended for their own use. Information, education and capacity building for RES will be implemented at national level.

#### MEN-17: Space-planning regulation preconditions for the use of renewables

Defining guidelines and criteria for the organization of specific spatial-functional elements for the use of RES, improved and cross-sectoral harmonization of spatial-planning conditions for determining the space suitable for the construction of RES plants at the state, county and local level. Guidelines and criteria will be adopted for determining the spatial-planning conditions for the use of space intended for the construction of RES facilities (specific spatial-functional elements in space) and for the exploitation fields of geothermal water for energy purposes. The conditions for determining the location and construction of RES plants will be integrated into the spatial plans of all counties.

#### MEN-18: Encouraging the use of renewables for electricity and heat production

Provision of financial incentives for the development of RES projects for electricity and heat production. Encouraging the use of RES for electricity and heat production will be implemented at national level.

#### MEN-19: Develop a regulatory framework for the use of renewables

The existing legal framework needs to be supplemented and procedures and practices developed. The goal by 2022 is to fully adopt the regulatory framework and established procedures at national level.

#### MEN-20: Integrated energy source and energy security planning

A top measure for increasing energy security is integrated security of supply planning, in the context of all energy products and all energy systems. Integrated planning must be harmonized at local, regional and national level, and in accordance with energy planning carried out by energy entities for energy infrastructure across the territory of the Republic of Croatia. In

addition, integrated planning needs to be aligned with alternative fuel planning and alternative fuel infrastructure. This planning will be carried out within the framework of the revision of the Integrated Energy and Climate Plan, which must be completed by 23 June 2023, and in the framework of the preparation and revision of the following plans. To this end, it is necessary to supplement the existing regulatory framework.

#### MEN-21: Construction and use of energy storage tanks

In order to increase the energy storage capacity of the system and increase the regulatory capacity of the electricity system, it is planned to build additional reversible power plants with a capacity of 150 MW before 2030, then the development of heat storage tanks for end customers, the development of battery tanks, the introduction of charging stations for electric vehicles that allow energy storage and the use of other innovative energy storage technologies (EU-funded).

#### MEN-22: Development and maintenance of central heat production system

Centralized thermal systems have been identified as one of the priorities of the energy policy of the Republic of Croatia. The most significant potential for the development and improvement of the existing centralized thermal systems is primarily in increasing the energy efficiency of production units, infrastructure and equipment for end users and increasing the reliability and security of supply. Therefore, this measure oversees the maintenance and upgrading of existing CTS systems, stopping the trend of disconnecting customers from the CTS system, introducing heat storage tanks for electricity, and using RES for CTS and replacing existing CTS production with renewable sources (eg biofuels), using heat pumps.

#### MEN-23: Construction of LNG terminal

he size of the LNG terminal depends on market interest and the first phase is planned to build an FSRU ship (ship for gas storage and gasification) with a maximum annual natural gas supply of up to 2.6 billion cubic meters. The planned maximum capacity of natural gas deliveries from the terminal, and indirectly its size and capacity, is conditioned on the maximum capacity of the gas pipeline system, which, with the construction of the first part of the evacuation pipeline system; Omišalj-Zlobin gas pipeline amounted to 7.2 million m<sup>3</sup>/day. With the construction of the extension of the Zlobin-Kozarac evacuation pipeline, the total capacity of the UPP terminal would increase to 12 million m<sup>3</sup>/day, and with the additional construction of the Kozarac-Slobodnica pipeline the capacity would increase to 19 million m<sup>3</sup>/day. It is estimated that the total investment for the construction of the first phase of the LNG terminal would be just over HRK 1.7 billion, with the planned start up on January 1st 2021.

#### MEN-24: Refinery modernization

Implementation of investments in modernization and improvement of production in order to maintain the competitiveness of refineries.

#### MEN-25: Measures to increase energy efficiency by improving processes and process units

Increasing energy efficiency is achieved by implementing measures that contribute to reducing energy intensity through more rational use of energy and raw materials and by altering production processes and equipment at pumping stations and refineries, which contributes to reducing fugitive emissions.

#### MEN-26: Methane flaring

In order to reduce fugitive emissions, instead of fuming methane, methane is burned on a torch. In this way, methane emissions are reduced by 95-99% depending on the efficiency of the flares.

#### MEN-27: Development of the Transmission Power Network

Croatian Transmission System Operator d.o.o. (hereinafter referred to as: HOPS) is, under the Energy Act (OG 120/12; 14/14; 95/15; 102/15, 68/16), the energy entity responsible for the management, operation and operation, maintenance, development and construction portable electricity networks. Pursuant to the Electricity Market Act (OG 22/13, 95/15 and 102/15, 68/18, 52/19), HOPS, as the owner of the 110 kV to 400 kV transmission network, is obliged to produce and adopt, with the prior consent Croatian Energy Regulatory Agency (hereinafter: HERA), ten-year, three-year and one-year investment plans for the development of the transmission network. Ten-year development plans are updated annually. At the time of adoption of this document, the Ten-Year Transmission Network Development Plan 2019-2028 was relevant, with detailed elaboration for the initial three-year and one-year periods approved by HERA in July 2019. The plan will be continuously updated throughout the implementation period of this document.

#### MEN-28: Development of the gas transmission system

Planning for the development of the transmission system is carried out through the development of a 10-year plan for the development of the gas transmission system, the development of which is the obligation of the gas transmission system operator pursuant to the Gas Market Act (OG 18/18). The gas transmission system operator is Plinacro d.o.o. The ten-year gas transportation system development plans are updated annually and approved by HERA. At the time of adoption of this document, the Ten-Year Plan for the Development of the Gas Transportation System of the Republic of Croatia 2018-2027 was relevant. The plan will be continuously updated.

#### MEN-29: Development of the regulatory framework for the electricity market and active participation of customers on the electricity market

In order to enable the active role of network users in the electricity market, the existing regulatory framework should be appropriately amended and supplemented, in particular by introducing an aggregator as a market player and by facilitating the launch of a pilot ancillary service project. Pilot projects will analyze in detail the services that users can provide to the distribution or transmission system operator. The possible types, extent, manner and period of

the provision of ancillary services will be analysed. Obstacles to the use of ancillary services will be identified and ways to remove them will be suggested. The potential for the provision of ancillary services and flexicurity services by network users will be carried out beforehand, which will define the manner and model of the provision of ancillary services and consumption responses by network users.

MEN-30: Introduction of advanced measuring systems and advanced measured data management

In order to enable the further development of energy markets and the active role of energy buyers in the energy markets, it is planned to introduce advanced metering devices and systems at the consumption level.

MEN-31: Adoption and implementation of the Energy Poverty Reduction Program

Mitigating energy poverty and its vulnerability; setting up an energy poverty monitoring system.

### **4.3.2. Transport**

In addition to the energy sector, measures from the Transport sector were also taken from the Energy Strategy, the Integrated National Energy and Climate Plan of the Republic of Croatia for the period from 2021 to 2030 and the Low Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050.

MTR-1: Providing information to consumers on fuel economy and CO<sub>2</sub> emission of new passenger cars

Pursuant to the Ordinance on Availability of Information on Fuel Economy and CO<sub>2</sub> Emissions from Passenger Cars (OG 7/15) each supplier of new passenger cars intended for sale shall provide consumers with information on the fuel consumption rate and specific CO<sub>2</sub> emission of passenger cars. The Ministry of Interior which is responsible for the road transport safety, on the basis of the Ordinance once a year, not later than 31 March of the current year, makes a Guidelines on cost-effectiveness of fuel consumption and CO<sub>2</sub> emission from new passenger cars available for purchase on the market in the Republic of Croatia. The Guidelines contains required information for each model of new passenger cars available in the domestic market.

MTR-2: Special fee for environment on the motor vehicles

The existing system of payment of the special environmental fee for motor vehicles is regulated by the Law on the Environmental Protection and Energy Efficiency Fund (OG 107/03, 144/12), the Regulation on unit fees, corrective coefficients and the related criteria and criteria for determining the special environmental fee to motor vehicles (OG 114/14, 147/14). A special fee is charged taking into account the type of engine and fuel, engine capacity, vehicle type, CO<sub>2</sub> emissions and age of the vehicle.

### MTR-3: Special tax on motor vehicles

Based on the polluter pays principle, the calculation model is based on the emission of CO<sub>2</sub> into the air from motor vehicles. The special tax is determined on the basis of the sales or market price of the motor vehicle, the CO<sub>2</sub> emissions expressed in grams per kilometer, the engine volume in cubic centimeters and the level of greenhouse gas emissions. This special tax encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions. The enactment of the Special Motor Vehicle Tax Act (OG 15/13, 108/13, 115/16, 127/17) ensured the implementation and enforcement of the measure.

### MTR-4: Monitoring, reporting and verification of greenhouse gas emissions in the lifetime of liquid fuels

In accordance with the Air Protection Act (OG 130/11, 47/14, 61/17), a supplier placing fuel on the domestic market will monitor greenhouse gas emissions per unit of energy for the duration of the fuel. Suppliers should draw up a report to be verified and submitted to the Ministry of Environment and Nature - Institute for Environmental and Nature Protection.

### MTR-5: Legislative adjustments for cleaner transport

Amend laws and by-laws to ensure the development of alternative fuel infrastructure, to increase the share of renewable sources in direct energy consumption in transport, and to promote clean and energy-efficient vehicles in road transport.

### MTR-6: Financial incentives for the purchase of energy efficient vehicles

In the context of co-financing cleaner transport projects, it is necessary to define specific co-financing lines for specific purposes for the purchase of vehicles powered by electricity, CNG/CBG, LNG/LBG and hydrogen. Incentive co-financing measures for vehicle procurement should be carried out consistently and continuously, focusing primarily on alternative fuels for which an assessment of the existing situation showed a low representation of vehicles in the total number of vehicles, and will be limited in time until monitoring shows a minimal representation of vehicles. The minimum market launch will be considered to be a 1 percent share of alternative fuel vehicles in the total number of vehicles registered in the country.

### MTR-7: Development of infrastructure for alternative fuels

The objective of this measure is to facilitate the uptake of alternative fuels by users/consumers by strengthening the alternative fuels distribution infrastructure and implementing common technical specifications for this infrastructure. The measure follows Directive 2014/94/EU on the establishment of alternative fuel infrastructure, the Law on the establishment of alternative fuel infrastructure (OG 120/16) and the National Policy Framework for the Establishment of the Infrastructure and the Market for Alternative Fuels in Transport (OG 34/17; NOP) and encourages the construction of filling stations in accordance with the aforementioned documents. This infrastructure measure will not directly affect the reduction of fuel

consumption in transport, but certainly the development of infrastructure is a necessary prerequisite for the development of markets for vehicles and vessels using electricity, CNG/CBG, LNG/LBG and hydrogen in Croatia.

The incentive measures for infrastructure co-financing will be primarily oriented towards alternative fuels for which an assessment of the existing situation has shown that the infrastructure is underdeveloped and will be limited in time until monitoring shows a minimum coverage of the infrastructure. The minimum infrastructure coverage will be considered to be the one that meets the objectives of the minimum NOP infrastructure.

#### MTR-8: Promotion of integrated system for the transport of goods

The measure is regulated by the Combined Carriage of Goods Act (OG 120/16), or the Ordinance on Incentives in Combined Carriage of Goods (OG 5/18), which stipulates incentives in combined transport of goods by rail, inland water or sea, and incentives in combined transport freight by road section.

#### MTR-9: Encouraging the development of sustainable integrated transport at national level

The measure monitors the general and specific objectives defined in the Transport Development Strategy of the Republic of Croatia (2017 - 2030) in the context of energy efficiency of rail, road, maritime, inland waterway and urban, suburban and regional transport (railway modernization, signalling system, renewal fund of locomotives, wagons, fleet of vessels, logistic integrated platforms, integrated public transport of passengers, etc.). Rail and generally multimodal infrastructure are lagging behind in comparison to highway infrastructure in terms of quality and connectivity. Investments are planned to develop a sustainable, integrated trans-European climate-resilient transport network. In maritime and inland waterway transport, the Republic of Croatia, in consultation with the other Member States, will analyse the feasibility of introducing appropriate mechanisms to ensure the transition to low carbon solutions, in particular with regard to the application of alternative energy sources for navigation. In this context, an action plan for shipping will be defined, which will define appropriate emission standards for the coming period. Also, in air transport, the Republic of Croatia will define a plan and elaborate detailed guidelines for achieving significant reductions in greenhouse gas emissions.

#### MTR-10: Promoting integrated and intelligent transport and developing local and regional alternative fuel infrastructure

It is necessary to promote the sustainable development of urban transport systems by optimizing freight transport logistics and intelligent management of public parking areas (ICT technologies), introducing integrated passenger transport, introducing car-sharing schemes in cities, introducing low-emission zones in cities, introducing public transport systems for urban bicycles and construction of associated bicycle infrastructure, intelligent transport management (upgrading, adaptation and replacement of obsolete signalling devices and equipment, installation of advanced transport equipment and intelligent traffic lights equipped with an autonomous renewable energy system, construction and equipping of central operational centers for the control and management of intersections with traffic lights set). At local levels,



continuous development and implementation of Sustainable Urban Mobility Plans and/or Strategic Plans, which build on existing planning practices and take into account integration, participatory and evaluation principles, are needed to meet the needs of urban residents for mobility, now and future, and ensure a better quality of life in and around cities. The activities will be accompanied by appropriate outreach campaigns.

#### MTR-11: Training for drivers of road vehicles for eco-driving

The aim of the measure is to raise awareness of the benefits of energy-efficient driving. Education on eco-driving elements is carried out by short trainings (lasting about 60-120 minutes per candidate) among drivers who have obtained a driver's license prior to the entry into force of the Ordinance on the training of candidates for drivers (OG 13/09, 132/17), whereby an obligation for all driving schools and instructors to undertake eco-driving training during the candidate's standard driver training. Specific elements of the national campaign should be dedicated to eco-driving education for drivers of passenger cars, buses, commercial and heavy goods vehicles.

#### MTR-12: Encouragement of alternative fuel use in ship transport system

In accordance with the National Coastal Maritime Transport Development Plan and considering that the Republic of Croatia is a maritime country with developed long-distance liner transport, and in addition has navigable river routes and lakes, this measure would co-finance projects for the gradual transition of the existing obsolete fleet to alternative and/or hybrid solutions and new construction. Ships using alternative fuels are generally more expensive than ships using conventional fuels, so there is no expressed interest of shippers to invest in such ships. Therefore, it is necessary to financially support the conversion/construction of such vessels to the extent that the purchase price is equalized or puts such a ship in the same position as a ship using conventional fuel ships. This measure builds on the measure related to the development of alternative fuel infrastructure in terms of end users/consumers on that infrastructure, while significantly affecting the potential reduction of pollution of the sea, rivers and lakes.

#### MTR-13: Advanced Biofuel Market Development Plan

Increase of RES share in transport by 2030 development of the advanced fuels market and achievement of the planned share of advanced fuels in direct energy consumption in transport through the least cost criteria and the largest multiplier. The implementation of the measure is based on amendments to the relevant laws and bylaws based on the Directive on the promotion of the use of energy from renewable sources, and in particular to establish conditions for monitoring the sustainability of biofuels and greenhouse gas savings.

### **4.3.3. Industrial processes and product use**

The Industrial Strategy of the Republic of Croatia 2014 – 2020 defines objectives of industrial development and key indicators of the Croatian industry in the period from 2014 to 2020.

According to the “realistic scenario”, by the year 2020 achieving the level of physical volume of industrial production on the level of 2008 is expected, when it reached the highest level of economic activity in Croatia.

The following measures are included in projections:

MIP-1: Reduction of clinker content in cement production

Increasing the proportion of mineral additives in cement depending on the composition of the raw material, the availability of additives of the appropriate composition on the market and the market requirements for certain types of cement.

MIP-2: Limiting fluorinated greenhouse gas emissions

Implementation of Regulation (EU) No 517/2014 in the Republic of Croatia is regulated by the Law on Implementation of Regulation (EU) No 517/2014 of the European Parliament and of the Council on April 16<sup>th</sup> 2014 regarding fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 (OG 61/17, 118/18), effective from January 1<sup>st</sup> 2019. The measure defines activities and procedures for the prevention of fluorinated greenhouse gas emissions, conducting equipment leakage checks, use of equipment with leakage detection systems, keeping records of equipment on which leakage checks should be carried out, collection of fluorinated greenhouse gases to ensure their recovery, recovery or elimination, the development of a producer responsibility system for the collection of fluorinated greenhouse gases and their renewal, recovery or destruction, and the implementation of training and certification programs.

MIP-3: A gradual decrease in the amount of hydrocarbons put on the market

The measure refers to the gradual limitation of the amount of hydrocarbons available on the EU market by 2030 to 21% of the total quantity of hydrocarbons placed on the market during the reference period 2009 to 2012 as laid down in Regulation (EU) No 517/2014.

Regulation (EU) No 517/2014 introduces a system of quotas for the placing on the market of hydrocarbons. The calculation of the benchmarks and the allocation of quotas should be based on the reported quantities of hydrofluorocarbons placed on the market during the reference period 2009-2012. The quotas for the placing on the market of hydrocarbons shall be allocated to each producer and importer for each year, beginning in 2015, on the basis of benchmarks, applying defined percentages to calculate the maximum amount of hydrocarbons to be placed on the market and the allocation mechanism.

MIP-4: Restrictions and prohibitions on placing certain products and equipment on the market

The measure relates to restrictions and prohibitions on the placing on the market of certain products and equipment containing fluorinated greenhouse gases as laid down in Regulation (EU) No 517/2014.

Fluorinated greenhouse gases with high greenhouse potential are restricted for use in new refrigeration and air-conditioning equipment, fire extinguishing systems, foam suppressants and aerosols.

#### MIP-5: Reduction of fluorinated greenhouse gas emissions from mobile air-conditioning systems

Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 on emissions from the air-conditioning system in motor vehicles and amending Council Directive 70/156 / EEC was implemented in three stages. The last phase came into force on January 1st 2017 by limiting the possibility of retrofitting air conditioning equipment designed to contain fluorinated greenhouse gases with a global warming potential of more than 150 in motor vehicles, and prohibiting the charging of air conditioning equipment with those gases.

### **4.3.4. Agriculture**

The positive impact of the implementation of measures on overall greenhouse gas emissions in the agriculture sector is reflected in the direct reduction of methane and nitrogen compounds emissions.

Measures included in the formation of scenarios of gradual transition of agriculture in relation to the referent scenario:

#### MAG-1: Change in livestock diet and feed quality

The objective of the measure is to reduce methane emissions from intestinal fermentation and the extraction of methane and nitrogen from manure management through changes in diet and changes in the composition of animal feed; improving the emissions reporting system. Emissions of greenhouse gases from livestock production are a direct consequence of the intestinal fermentation and decomposition processes of manure or are indirectly generated during food preparation or other farm operations. Therefore, the measures taken to reduce greenhouse gas emissions are aimed at regulating digestive processes. In practice, many measures are most often applied at the same time, some of them acting simultaneously on intestinal fermentation but also reducing emissions during the handling of manure. There are various measures that can have a significant impact on emission reductions, some of which are already being implemented and some are expected in the reference scenario. By 2020, further work is expected on the implementation and synergy of dietary change activities, the treatment of feeds with the aim of increasing their digestibility and the use of additives (additives) in animal feed. It is further possible to further reduce greenhouse gas emissions by implementing targeted sub-measures of dietary change, as well as improving the quality of bulk feeds and improving the feeding system.

#### MAG-2: Improving cattle facilities and systems of animal waste management

The objective of the measure is to reduce methane, nitrogen and ammonia emissions through improvements in animal nutrition and manure collection and storage systems. The fertilizer

management category is the source of emissions of nitrogen compounds, ammonia and particulates. The emission comes from the excreta of animal fertilizer deposited in and around the dwellings and collected as liquid slurry, solid fertilizer or fertilizer in a yard with the latter two being viewed together as solid fertilizers. Emissions come from animal housing and from the yard, from storage areas and from the application of fertilizer to the soil and during grazing.

#### MAG-3: Modification of livestock rearing system

Measures that have indirect effects on reducing greenhouse gas emissions relate to measures that increase the intensity of production per animal and per unit of time.

#### MAG-4: Anaerobic decomposition of manure and biogas production

The introduction of biogas plants results in the reduction of CH<sub>4</sub> emissions due to the use of litter as a renewable source and the production of electricity.

#### MAG-5: Improving the breeding program, animal health and welfare

The aim of the measure is to determine both phenotypic and genetic variations in predicted CH<sub>4</sub> emissions and to determine the potential of genetics to reduce CH<sub>4</sub> emissions in dairy cows, as well as increased production intensity.

#### MAG-6: Improvement and change of soil tillage system (reduced tillage)

Reduced tillage is the result of scientific research and practical checks that result in a change to the conventional tillage system by reducing the depth of tillage, omitting one or more work operations, reducing the frequency or completely omitting tillage, reducing the area under cultivation and retaining plant residues. The direct impact on greenhouse gas emissions is primarily related to the significant impact on soil organic carbon content and the reduced machine hours.

#### MAG-7: Extension of rows with a higher proportion of legumes

Sowing leguminous crops binds atmospheric nitrogen, reduces the risk of groundwater contamination, soil is enriched with organic matter, which has multiple positive effects on improving and maintaining the favorable physical, chemical and biological properties of the soil.

#### MAG-8: Intensification of crop rotation using intermediate crops

Sowing intermediate crops that can be used to feed livestock or plow for green fertilization will utilize the remaining nutrients, prevent further evaporation of soil water, reduce carbon loss from soil, prevent nitrogen leaching into groundwater and increase soil organic matter.

#### MAG-9: Improvement of mineral fertilizer application methods

Reducing the use of mineral fertilizers is an indirect benefit from other measures that reduce the need for their application, but with proper fertilization practices. The use of fertilizers can also directly affect the total amount of mineral fertilizers applied.

#### MAG-10: Improvement of organic fertilizer application methods

Organic fertilizers originate from organic sources such as solid manure or slurry and plant and animal residues, and more strongly stimulate soil microbial activity compared to mineral fertilizers. Using direct injection into the soil reduces nitrogen loss due to volatilization.

#### MAG-11: Agroforestry

Agroforestry is a common name for land management systems whereby permanent woody species are integrated with the cultivation of crops and/or animals on the same area unit. Certain agroforestry systems (eg agro-silviculture) are significant carbon outflows. It is necessary to establish through the experiment the applicability of agroforestry in our conditions with regard to different forms and divisions, but also to different needs.

#### MAG-12: Hydromelioration interventions and systems for protection against disasters

With the controlled application of mineral fertilizers, controlled drainage, re-use of drained water and the use of water of adequate quality are important to reduce nitrate emissions. Drainage has the function of draining excess water. Also, changes in soil air-water relationships also affect the activity of beneficial microorganisms.

#### MAG-13: Introduction of new cultivars, varieties and cultures

Decrease in the application of mineral nitrogen through the application of new cultivars with increased resistance and reduced need for nutrients, as well as specific legumes that have the ability of symbiotic relationship with nodule bacteria.

#### MAG-14: Changing the way people eat

The cultivation of livestock cereals produces much more greenhouse gas than the production of cereals for human consumption. By reducing the consumption of meat (especially red) in the diet for the benefit of plant-based foods, significant emissions reductions can be achieved as well as water savings.

#### MAG-15: Collection and processing of agricultural plantations and residues for energy use

Energy exploitation of post-harvest residues (with emphasis on crop production) is one of the most significant ways of producing biomass energy in the Republic of Croatia. Other possible sources are the remnants of the winter harvest of almost all horticultural species, as well as fast-growing energy crops that are planted/sown solely for the production of biomass for its conversion to energy.

In order to develop the biomass market, biomass collection and logistics centers will be established using existing infrastructure (utilities, competence centers, business zones) to reduce the unit cost of producing biomass products and capitalize on the innovation capacity and necessary equipment for innovative biomass products for bioeconomics. The collection and logistics centers will act as a link between the biomass farmer, the processing of biomass into new value-added products, the development of new products and the marketing of these new products.

#### **4.3.5. Waste**

For the purpose of effective implementation of the measures included in the Waste sector, along with the already adopted sectoral legislation that is harmonized with EU legislation, it is necessary to adopt a more significant number of measures. It will primarily impact on the projections after 2020 to measures described below:

##### **MWM-1: Preventing the generation and reducing the amount of solid waste**

It is the first in the order of priority in the waste management, pursuant to the Sustainable Waste Management Act (OG 94/13, 73/17, 14/19). The projections include municipal solid waste, industrial waste and sludge from wastewater treatment plants.

This measure is achieved by cleaner production, education, economic instruments and enforcement of regulations in waste management, and by investing in modern technologies. According to the Act, quantitative targets and deadlines for reducing the total amount of waste disposed to non-compliant landfills are defined. Disposal of waste to non-compliant landfills in Croatia is prohibited after 31 December 2017.

According to Directive (EU) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste, Member States should take the necessary measures to ensure that by 2035 the amount of municipal waste landfilled is reduced to 10% or less of the total amount of municipal waste generated (by weight). Croatia was given the possibility of a delay of five years to meet the target because it is among the Member States that are in 2013 landfilled more than 60% of its municipal waste. The five-year delay is included in the projections. In this case, Croatia must take the necessary measures by 2035 to reduce the amount of municipal waste landfilled to 25% or less of the total amount of municipal waste generated (by weight).

##### **MWM-2: Increasing the amount of separately collected and recycled solid waste**

Beside the Sustainable Waste Management Act, the Waste Management Plan of the Republic of Croatia for the period 2017 – 2022 (OG 3/17) also defines the quantitative targets and deadlines for increasing the amount of separately collected and recycled waste. By 2020, it is necessary to secure the preparation for reuse and recycling of the following waste materials: paper, metal, plastic and glass from households and possibly from other sources if these waste streams are similar to the waste from households, with the minimum share of 50% by waste weight.

According to Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste, Member States should take the necessary measures to ensure that preparing for re-use and the recycling of municipal waste be increased to a minimum of 55% by weight till 2025, 60% by weight till 2030 and 65% by weight till 2035. Croatia was given the possibility of a delay of five years to meet the target because it is among the Member States that are in 2013 prepared for re-use and recycled less than 20% of its municipal waste. The five-year delay is included in the projections. In this case, Croatia must take the necessary measures to increase the preparing for re-use and the recycling of municipal waste to a minimum of 50% by weight till 2025, 55% by weight till 2030 and 60% by weight till 2035.

#### MWM-3: Providing a system for the treatment and use of landfill gas

The Ordinance on the Methods and Conditions for the Landfill of Waste, Categories and Operational Requirements for Landfills (OG 114/15, 103/18, 56/19) and Ordinance on the Waste Management (OG 117/17) regulate technical requirements for landfill operation, which reduces possible adverse effects of landfills on the environment. On landfills where landfill gas occurs it is necessary to secure a gas collection system, and that gas must be treated and used. If collected landfill gases cannot be used for energy production, they should be burned in the area of the landfill and the emission of methane into the atmosphere should be prevented.

Implementation of binding targets for reduction of waste disposal and waste recycling, described within MWM-1 and MWM-2 measures, affects the amount of generated landfill gas, which is included in the projections.

#### MWM-4: Reducing the amount of disposed biodegradable waste

The aim of this measure is to reduce the amount of biodegradable fraction of waste disposed at landfills, thus reducing methane emissions resulting from anaerobic decomposition of waste. Pursuant to the Sustainable Waste Management Act, quantitative targets related to the reduction of biodegradable municipal waste disposed to landfills are established. By the end of 2020, the share of biodegradable municipal waste disposed of in landfills must be reduced to 35% weight of biodegradable municipal waste generated in 1997.

Implementation of binding targets for reduction of waste disposal and waste recycling, described within MWM-1 and MWM-2 measures, affects reducing the amount of disposed biodegradable waste, which is included in the projections.

#### MWM-5: Use of biogas for biomethane production and electricity and heat generation

The measure is related to the OIE-3 measure: Encouraging the use of RES for electricity and heat production, within the framework of renewable energy sources and measures from the Transport sector related to the use of renewable energy sources in transport. Looking at the waste management sector, the greenhouse gas reduction potential of this measure represents the potential for reducing methane emissions (produced by anaerobic digestion of the

biodegradable fraction of waste), which is used to generate electricity and heat. Biomethane injection into the gas network is also envisaged.

#### **4.3.6. LULUCF**

##### MLF-1: Development of the Land Management Strategy of the Republic of Croatia

By 2027, it is necessary to develop a Land Management Strategy of the Republic of Croatia. For the development of the same, it is necessary to implement projects that:

1. Establish a unique land information system in the Republic of Croatia or determine the areas of each LULUCF land category by using spatially determined data, for each land category and for each type of land conversion from one land category to another
2. Conducts analysis of all LULUCF land categories depending on cover, land use and management practices used on each land and associated emissions/removals to consider the potential of each of the storage sites within each LULUCF land category to reduce emissions and increase greenhouse gas outflows
3. Make detailed projections for the development of future emissions/removals in the LULUCF sector after carrying out the above analysis

The calculation of emissions/removals in the LULUCF sector and these projects should form the basis for planning the cover, use and management of LULUCF land categories for each of the storage sites in order to develop a Land Management Strategy and to properly define the measures to be implemented in each land category which will reduce emissions and increase greenhouse gas outflows in the Republic of Croatia. Improving and defining forest fire protection measures should be an integral part of this strategy.

##### MLF-2: Carbon accumulation on areas of existing forests

Carrying out activities that contribute to increasing the carbon footprint of forests, in particular in the biomass storage facility and ensuring that removals in a given period exceed those defined by the Forest Reference Level (FRL). These activities are, for example, reforestation, conversion of stands to a higher cultivation form, selection of species for replenishment, etc. Maintaining a removal larger than that defined by the FRL also ensures an increase in emission units that can be transferred to sectors outside the ETS. Maintaining a removal greater than that defined by the FRL also ensures the use of flexible mechanisms. Further assessment of the effectiveness of the implemented measures and activities from the Rural Development Program to reduce/contain emissions and increase/contain greenhouse gas removals and develop new guidelines for further management in the forestry and agricultural sector with the application of measures to mitigate and adapt to climate change. It is necessary to promote the management of land categories that are beneficial to the climate and the environment, and to develop further development guidelines based on the knowledge and experience gained from the implementation of this measure.

##### MLF-3: Reforestation works



Afforestation on non-forested areas (in terms of IPCC methodology) is an activity that generates removals. Due to the regulations in the field of nature protection governing the establishment of Natura 2000 sites, the Republic of Croatia is not able to dispose of all lawn areas (according to the national regulation: non-overgrown production forest land) for afforestation purposes. Considering that there are non-cultivated agricultural areas in the Republic of Croatia that have been neglected for many years, the problem of these areas must be adequately addressed when developing the Land Management Strategy. It is necessary to evaluate the justification for the conversion of these areas to forest areas by the implementation of afforestation. It should be borne in mind that there is no restriction on the application of the amount of removal when calculating removals due to reforestation, and that these removals are fully taken into account in the calculation. An assessment of the effects of afforestation of additional non-overgrown, productive forest land on the fulfillment of Croatia's obligations related to the use of renewable energy sources is also needed. Guidelines for further development based on the knowledge and experience gained from the implementation of afforestation activities need to be developed. In case of introduction of afforestation measure on neglected agricultural land, the measure will require strengthening of seed production and nursery services in the forestry sector and cultivation of planting material necessary for the implementation of these works.

#### MLF-4: Manufacture and use of wood and wood products

Harmonizing the available data and statistical reports and conducting new research to agree on the information available for the purposes of different reporting to international organizations in order to provide accurate, transparent and high quality reporting, as well as to create harmonized bases for the adoption of medium and long-term strategies in the forestry and wood processing sector. It implies mapping of forestry and timber industrial production. Encourage the use of wood products in traditional and new products in order to increase removals and reduce greenhouse gas emissions in the wood storage facility. This also requires the regulation of exports of untreated and semi-treated timber, which encourages the development of the domestic timber industry, and the regulation of energy timber exports increases the share of energy production from renewable sources, thus fulfilling international commitments. Outflow-generating activities must be promoted to ensure that timber products and timber are used for energy purposes in ways that contribute to meeting both EU targets by 2030 (reducing emissions and increasing the share of renewables in total energy consumption) and are beneficial to climate and environment. Guidelines for further development should be drawn up based on the knowledge and experience gained from the implementation of this measure.

#### MLF-5: Agricultural land management

Conducting activities in the management of agricultural land in a way that contributes to reducing the emission factor is of interest to family farms, since the CAP regulations of EC regulations increase the level of incentives if the emission factor is lower due to the way they are managed. Land management practices that can affect emissions and removals, for example in soil storage, are: soil treatment methods, crop/crop life (rotation period) and crop/plantation type, fertilizer application, residue management, erosion control, application of irrigation systems. It is necessary to promote activities in a climate and environmentally beneficial

manner, and to develop further development guidelines based on the knowledge and experience gained from the implementation of this measure.

#### MLF-6: Grassland management

Conducting pasture management activities in a way that contributes to the reduction of the emission factor is of interest to family farms, since the CAP regulations of the EC regulations increase the level of incentives if the emission factor is lower due to the management of these areas. Activities in a climate and environmentally beneficial manner should be promoted, and further development guidelines drawn up based on the knowledge and experience gained from the implementation of this measure.

#### MLF-7: Implementation of technical projects and scientific research in the LULUCF sector

In the period up to 2030 and 2050, it is necessary to provide funding for the implementation of technical and scientific projects in the LULUCF sector. Scientific projects should enable the development of different models for the purposes of moving to a higher level of IPCC methodology (Tier 3) with the aim of determining as accurately as possible GHG emissions/outflows and, consequently, planning measures to reduce emissions and increase outflows.

### **4.3.7. Other (cross-cutting) policies and measures**

#### MCC-1: Committee for cross-sectoral coordination of policies and measures for mitigation and adaptation to climate change

The Commission, established in 2014, is responsible for monitoring and evaluating the implementation and planning of climate change mitigation and adaptation policies and measures in the Republic of Croatia. The Committee members include representatives of relevant government bodies and other relevant organizations, agencies and non-governmental organizations. The composition of the Commission, the affairs and manner of work of the Commission shall be determined by the Croatian Government of Croatia at the proposal of the ministry responsible for environmental protection.

#### MCC-2: Encouraging the establishment of regional energy and climate agencies and capacity building

Regional energy agencies are not currently active in the whole of the Republic of Croatia, and capacity building of existing regional energy agencies in the field of climate change is needed and their transformation into energy and climate agencies. The aim of this measure is to encourage the establishment of regional energy agencies for the areas of the Republic of Croatia in which they do not operate and to transform the existing energy agencies into energy and climate agencies.

#### MCC-3: Promotion of the use of innovative information and communication technologies (ICT) to reduce greenhouse gas emissions

Innovative information and communication technologies are playing an increasingly important role in reducing greenhouse gas emissions and increasing energy efficiency. Intensifying their use in public administration, services and production processes will increase productivity and efficiency while reducing energy consumption and the resulting greenhouse gas emissions. The measure is expected to increase the use of innovative ICTs and monitor real energy savings and reductions in greenhouse gas emissions.

#### MCC-4: Emissions Trading System

Through an even distribution of emission allowances, reduction commitments are distributed to system participants from all Member States with the aim of contributing to a reduction of emissions at EU level of at least 43% by 2030 compared to 2005 levels.

#### MCC-5: CO<sub>2</sub> emission tax for non-EU ETS stationary sources

Regulation on unit charges, corrective coefficients and detailed criteria and benchmarks for determination of the fee for emissions into the environment of carbon dioxide (Official Gazette 73/07, 48/09, 02/18) provides for the payment of fees on CO<sub>2</sub> emissions for all stationary sources that emit more than 450 tonnes of CO<sub>2</sub> per year. Compensators who pay for energy efficiency investments, RES and other measures to reduce CO<sub>2</sub> and other greenhouse gas emissions are charged a lower fee. The Environmental and Energy Efficiency Fund is authorized to calculate and collect costs. From 2013 onwards, the obligation to pay the CO<sub>2</sub> emission allowance applies only to sources not covered by the ETS.

#### MCC-6: Covenant of Mayors for Climate and Energy in the Republic of Croatia

The signatories to the Agreement support a common vision for 2050: accelerating the decarbonisation of their territories, strengthening the capacity to adapt to the inevitable impact of climate change, and providing citizens with access to safe, sustainable and affordable energy. The agreement covers 82 cities and municipalities, or more than 2 million inhabitants in the Republic of Croatia.

#### MCC-7: Charter for Cooperation for Decarbonisation of Buildings by 2050

Charter for Cooperation for Decarbonisation of Buildings by 2050, launched by the Ministry of Construction and Physical Planning, which supports the EU's vision for decarbonisation of buildings by 2050 - The Charter was launched to improve inter-ministerial communication and cooperation between public authorities and the real sector. The aim is to create, through workshops and open partner dialogue, a wide network of connected professionals who are ready for joint dialogue and contribution to the decarbonisation of the building stock by 2050. Open partner dialogues bring together representatives of state and local government, academia and the professional public, the construction and energy sectors and related industries at thematic workshops organized by the Ministries of Construction and Physical Planning. The contents of the charter relate to the achievement of energy and climate goals at national and EU level through the decarbonisation of the building stock, the renovation of buildings and the

construction of near-zero energy buildings, aware of the importance of further reducing greenhouse gas emissions, increasing the share of renewable energy sources, improving energy security and introducing innovation and smart technologies that enable buildings to support the overall decarbonisation of the economy. The signing of the Charter encourages continued cooperation on the development of a Long-Term National Building Fund Restoration Strategy and the transition to a near zero energy building standard (nZEB). The signatories of the Charter support and promote the decarbonisation of buildings in their further activities, wherever possible.

#### MCC-8: Establishment of a platform for the CO<sub>2</sub> collection, use and storage

Carbon capture and storage technology for large emission sources is not yet commercially available. According to Directive 2009/31 / EC on the geological storage of carbon dioxide, ie Article 36 of Directive 2010/75 / EU on industrial emissions, for power plants with a capacity of more than 300 MW which have received a building permit after the entry into force of Directive 2009/31 / EC geological storage of carbon dioxide, it is necessary to assess whether the following conditions are met: a) availability of suitable storage location, b) technical and economic feasibility of transport facilities, and c) technical and economic feasibility of upgrading CO<sub>2</sub> capture and collection facilities. If these conditions are met, the competent authority must provide at the installation site adequate space for the equipment to capture and compress the extracted CO<sub>2</sub>. Legally, this is covered by the Law on Hydrocarbon Exploration and Exploitation (OG 52/18, 52/19), which enables the storage of CO<sub>2</sub> on the territory of the Republic of Croatia. This method needs to be further developed and the potentials and opportunities for this technology at country level should be considered. Accordingly, it is planned to develop a study of the assessment of storage capacities, but also to develop a National Feasibility Study with an action plan for preparatory activities for CCS projects. This study will cover the capture stages of the emission sources, transport, injection and storage of CO<sub>2</sub>, and the interconnection of the CO<sub>2</sub> transport system with other EU countries. Activities include:

- conducting research into the potential for geological storage of CO<sub>2</sub> in the Republic of Croatia,
- drafting / supplementing a study on the assessment of storage capacities available in the territory of the Republic of Croatia,
- implementation of projects of geological storage of CO<sub>2</sub> in the Republic of Croatia in accordance with the expressed potentials.

#### MCC-9: Improving sustainability of urban areas

The Ministry of Construction and Physical Planning is in the process of developing new national Green Infrastructure Development Programs in urban areas and the Circular Spatial Management and Building Development Program, which achieve the environmental, economic and social benefits of sustainable development. The Green Infrastructure Development Program in urban areas elaborates the goals and measures for the development of green infrastructure, which, among other things, have an impact on increasing the energy efficiency of buildings, reducing CO<sub>2</sub> emissions and reducing the temperature in thermal island areas in urban areas. The Circular Spatial and Building Management Development Program elaborates

goals and measures for circular spatial and building management that encourage, among other things, measures of circularity when planning new buildings, reusing abandoned and / or neglected and extending the durability of existing spaces and buildings, reducing the amount of construction waste, and increasing the energy efficiency of buildings. The aim of this measure is to encourage cities and municipalities to base their projects on the revitalization and development of new urban areas on the principles of sustainability.

#### MCC-10: Establishment of a Business Carbon Footprint Calculation and Reduction Program

The following activities will be implemented within the measure:

- improvement of the national carbon footprint model for businesses with an integrated database of national greenhouse gas emission factors,
- the establishment and implementation of a voluntary program to calculate and reduce the carbon footprint of businesses from 2021,
- monitoring and analysis of the achieved carbon footprint reduction of business entities, consideration will be given to the adoption of a by-law establishing the obligation to calculate the carbon footprint and developing an action plan for reducing the carbon footprint of business entities.

#### MCC-11: Circular economy platform establishment

It is necessary to develop a systematic approach in all value chains that relate to the Croatian economy and relate to the measures outlined in the Circular Economy Action Plan, on the basis of which the EC integrates the principles of the circular economy in the production and consumption of plastics, water management, food systems and special waste streams. It is necessary to set up a cross-sectoral thematic working group to identify the stakeholders in the circular economy (focus on industry and suppliers of raw materials, energy and packaging) and draw up a national action plan for the transition to the circular economy by adapting the legislative framework. The inclusion of the representatives of the Republic of Croatia in the Stakeholder Platform for the European Circular Economy provides direct access to, and cooperation with, innovation and best practices.

#### MCC-12: Bioeconomy platform establishment

In the context of bio-economy development, it is necessary to link three key aspects: the development of new technologies and processes; market development and the competitiveness of biomass-based sectors and the political will to co-operate with policy and stakeholders to achieve the bioeconomy in the Croatian context. This should ensure the transformation of existing "traditional" stakeholders of the bioeconomy (farmers, OPG, food processing, wood processing, pharmaceutical and chemical industries ...) into new, modern stakeholders whose products are no longer based on non-renewable carbon (bioplastics, biofuels, biochemicals, products of "traditional" stakeholders with a smaller carbon footprint ...) and prepare them for the announced EU funds for the transition to the bioeconomy. In order to move to the bioeconomy, it is necessary to adapt the sectors of agriculture, forestry and waste management in order to balance the supply and demand for biomass, which includes the establishment of collection and logistics centers for biomass and bio-refineries.

### MCC-13: Hydrogen technology platform establishment

The role of hydrogen in the energy and transport systems of the future is expected to be more significant, especially as the goals for reducing greenhouse gas emissions are more ambitious. It is therefore necessary to identify, in a timely manner, the opportunities associated with the use of hydrogen, to consider its use in the coming decade, and to explore the possibilities of financially stimulating hydrogen production and consumption. For that purpose, a hydrogen technology platform will be established, bringing together national stakeholders relevant to the research and application of hydrogen technology, monitoring the development of hydrogen technologies at EU and international level and serving as a link between national, EU and international levels.

### MCC-14: Energy Efficiency Obligation System for Suppliers

Obligated parties of the energy efficiency obligation scheme are energy suppliers. The goal is to reduce energy consumption by end consumers.

### MCC-15: Integrated energy efficiency monitoring information system

The national system for monitoring, measurement and verification of savings (SMIV) has been established, based on the Energy Efficiency Act and the Ordinance on the system for monitoring, measurement and verification of energy savings (OG 71/15). The system is extremely important because it monitors energy savings and the resulting reduction in greenhouse gases and the system data are used for reporting. In the next period, it is necessary to maintain and improve the functionality of the system, connect it to other systems (EMIS), and inform and educate obligated parties about the correct data entry required to calculate and verify energy savings.

### MCC-16: Green Public Procurement

A National Green Public Procurement Commission was established to monitor the implementation of the Green Public Procurement through a survey questionnaire and an electronic public procurement classifieds. This measure is a continuation of the initiated measures and further greening of the public procurement procedures. Green public procurement will favor innovative low-carbon products and services, further boosting their entry into the market and serving as a good example.

### MCC-17: Determination of starting points, national targets, indicators for monitoring achievement and establishment of systems for monitoring the achievement of the set objectives of research, innovation and competitiveness

Elaboration of monitoring objectives and systems and establishment of a monitoring system for achievements in the field of energy-related research and development, innovation and competitiveness; defining key technologies for low carbon transition.

MCC-18: Co-financing of industrial research and experimental development projects aligned with the National Development Strategy

The measure encourages research and development of products and services relevant to low-carbon development by co-financing research projects under priority themes.

MCC-19: Encouraging entrepreneurship development in the low carbon economy

The measure encourages the development of entrepreneurship in the area of low-carbon products and services, by co-financing entrepreneurial activities in this area.

MCC-20: Encouraging the knowledge and technology transfer from science to economy system with a focus on low carbon technologies

The measure encourages the development of established and functional technology transfer offices and science and technology parks with the aim of transferring knowledge and developing technologies that will contribute to the development of a low carbon economy.

MCC-21: Encourage further work of scientific centers of excellence established in the field of natural, technical, biotechnical and biomedical sciences

The measure encourages the continued work of established centers of excellence whose work has been positively evaluated in the periodic evaluation process with a view to further developing a low carbon economy.

MCC-22: Capacity building to stimulate research and innovation and increase competitiveness in the low carbon economy

The capacity of the institutions involved in stimulating and monitoring research, innovation and competitiveness in the low carbon economy will be built.

Annex I provides CTF Tables 3 and 4 that provide information on progress towards the achievement of an economy-wide target: information on climate change mitigation measures and their effects.

#### **4.4. ASSESSMENT OF THE ECONOMIC AND SOCIAL CONSEQUENCE OF RESPONSE MEASURES**

According to paragraph 24 of the Annex to Decision 15/CMP.1 Parties included in Annex II, and other Parties included in Annex I that are in a position to do so, shall incorporate information on how they give priority, in implementing their commitments based on relevant methodologies referred to in paragraph 8 of decision 31/CMP.1. As a transition country, in accordance with Article 22, paragraph 3 of the Convention, Croatia took over the obligations of the countries listed in Annex I. Therefore, Croatia is not obliged to provide financial or any other assistance to developing countries.

According to Article 4, paragraphs 8 and 9 of the Convention Croatia strives to implement Kyoto commitments in a way which minimize adverse impact on developing countries. In continuation information on implementation of policies and measures that minimise adverse social, environmental and economic impacts on non-Annex I Parties is provided.

To ensure that all relevant possible impacts are taken into account, the EU has established processes that assess the economic and social consequences of climate policy measures.

For the development of new policy initiatives through legislative proposals by the EC, an impact assessment system has been established in which all proposals are examined before any legislation is passed. It is based on an integrated approach which analyses both benefits and costs, and addresses all significant economic, social and environmental impacts of possible new initiatives.

a) Market imperfections, fiscal incentives, tax and duty exemptions and subsidies

The ongoing liberalization of energy market is in line with EU policies and directives. No significant market distortions have been identified. Consumption taxes for electricity and fossil fuels were harmonized recently. The main instrument addressing externalities is the emission trading under the EU ETS.

b) Removing subsidies associated with the use of environmentally unsound and unsafe technologies

In Republic of Croatia no subsidies for environmentally unsound and unsafe technologies have been identified.

c) Technological development of non-energy uses of fossil fuels

The Republic of Croatia has not participated actively in activities of this nature.

d) Carbon capture and storage technology development

The Republic of Croatia does not take part in any such activity.

e) Improvements in fossil fuel efficiencies



In 2019 The Fourth National Energy Efficiency Action Plan for the period until the end of 2019 has been drawn up in accordance with the template laid down by the EC, with which all EU Member States must comply. Measures for the period until the end of 2019 regarding energy efficiency are:

- supporting the use of renewable energy sources and energy efficiency by the Environmental Protection and Energy Efficiency Fund (the Fund),
- encouraging the use of renewable energy and energy efficiency through the Croatian Bank for Reconstruction and Development (HBOR),
- energy efficiency projects with repayment through savings (ESCOs),
- increasing energy efficiency in buildings
- energy audits in the industry,
- promoting energy efficiency in households and the services sector through project activities,
- labelling the energy efficiency of household appliances,
- metering and informative billing of energy consumption,
- eco-design of energy using products.

f) Assisting developing country Parties which are highly dependent on the export and consumption of fossil fuels in diversifying their economies

As regard of above mentioned activity the Republic of Croatia does not take part in any such activity.

## 5. PROJECTIONS

### 5.1. INTRODUCTION

This chapter presents the historical greenhouse gas emissions in the period from 1990 to 2016 and projections of greenhouse gas emissions for the period from 2015 to 2035. The emissions are presented as total emissions of greenhouse gases by sectors and by gases.

Since greenhouse gases have different irradiation properties and consequently different contribution to the greenhouse effect, emissions of each gas are multiplied by their Global Warming Potential (abb. GWP). In this case, the emission of greenhouse gases is presented as equivalent emission of carbon dioxide (CO<sub>2</sub> eq). In case of removing emissions of greenhouse gases, it refers to outflows (sinks) of greenhouse gas emissions and the amount is shown as negative value. The global warming potentials of individual gases that are used in this report are presented below in Table 5-1.

Table 5-1: Global Warming Potential

<b>GAS</b>	<b>GLOBAL WARMING POTENTIAL</b>
Carbon dioxide (CO <sub>2</sub> )	1
Methane (CH <sub>4</sub> )	25
Dinitrogen oxide (N <sub>2</sub> O)	298
HFC-23	14800
HFC-32	675
HFC-125	3500
HFC-134a	1430
HFC-143a	4470
HFC-152a	124
HFC-227ea	3220
HFC-236fa	9810
CF <sub>4</sub>	7390
C <sub>3</sub> F <sub>8</sub>	8830
C <sub>2</sub> F <sub>6</sub>	12200
SF <sub>6</sub>	22800

Sectors are identified according to the Guidelines for the preparation of National Communications by Parties included in Annex I to the Convention (FCCC/CP/1999/7, Part II):

- energy
- transport,
- industry,
- agriculture,
- waste,
- LULUCF.

Particularly the emissions of certain greenhouse gases are presented:

- CO<sub>2</sub>,
- CH<sub>4</sub>,
- N<sub>2</sub>O,
- HFCs and PFCs,
- SF<sub>6</sub>.

In accordance with the Guidelines for the drafting of the national report of the Parties to Annex I to the Convention, emissions are reported for two scenarios: the scenario 'with existing measures' and the scenario 'with additional measures'. The 'with existing measures' scenario covers the implementation of current policies and measures that are already being applied since the implementation of policies and measures have already been adopted. The 'with additional measures' scenario is based on the implementation of the planned policies and measures.

Emission projections start from the inventory of greenhouse gas emissions (NIR 2019) which includes an inventory of emissions and sinks of greenhouse gases for the period 1990 – 2017.

Reference year for projection is 2016.

## 5.2.PROJECTIONS OF GREENHOUSE GAS EMISSIONS

### 5.2.1. Projections of greenhouse gas emissions by sectors

Historical and projected trends in greenhouse gas emissions by sectors are presented in Figures Figure 5-1 Figure 5-2. Emissions are presented for 'with existing measures' scenario, 'with additional measures' scenario and 'with additional measures' scenario for the period from 1990 to 2035.

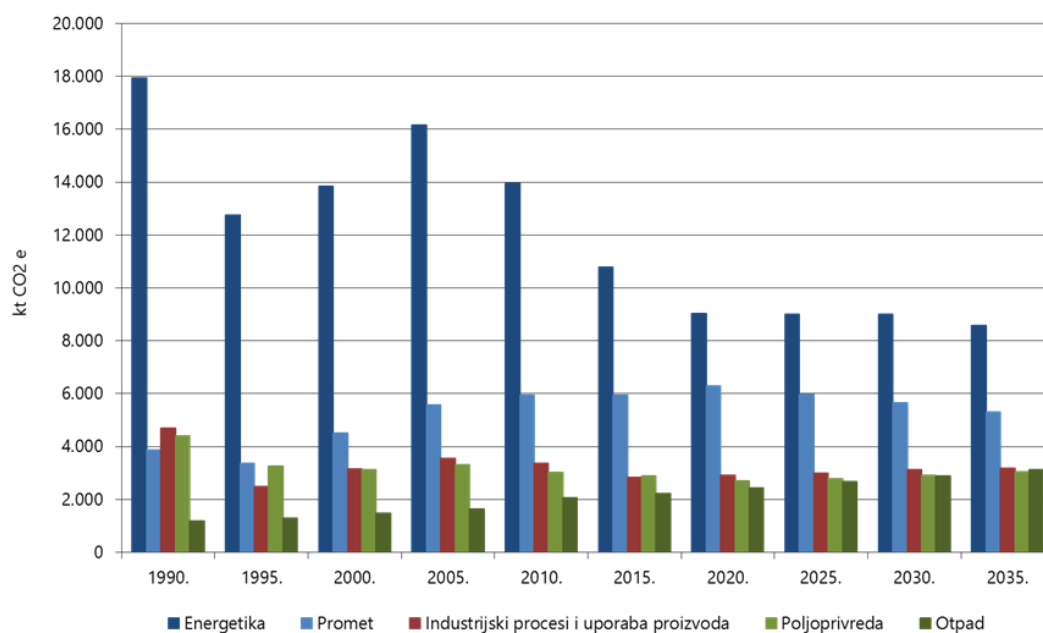


Figure 5-1: Historical and projected greenhouse emissions by sectors, 'with existing measures' scenario

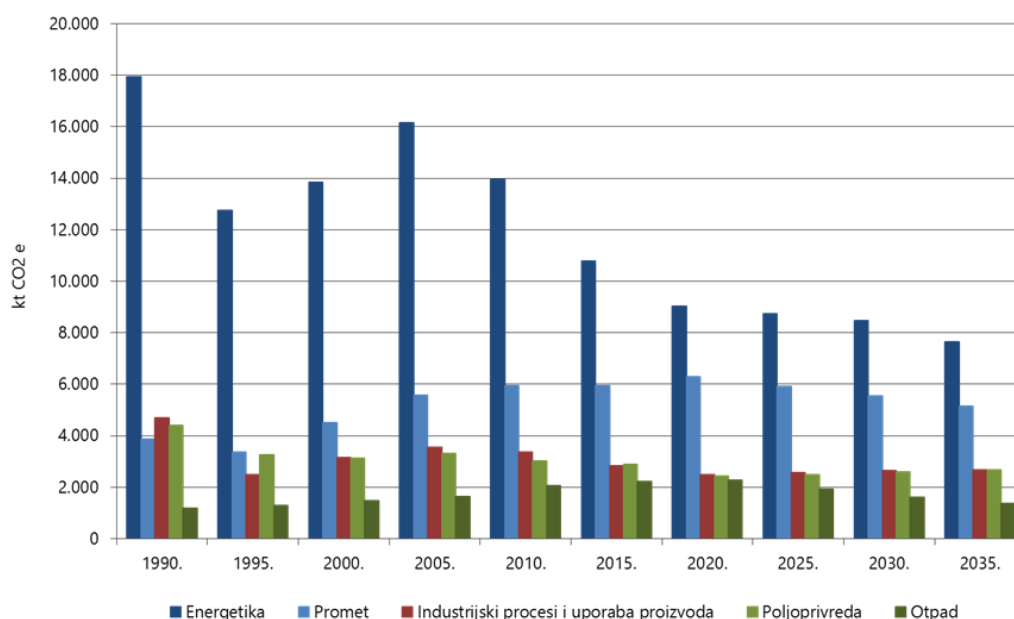


Figure 5-2: Historical and projected greenhouse emissions by sectors, 'with additional measures' scenario

The energy sector covers all activities that involve fuel combustion from stationary sources and fugitive emission from fuels. The emission from energy sector in 2016 amounted to 10,901 kt CO<sub>2</sub> and it is the main source of anthropogenic emission of greenhouse gases, it accounts approximately 44.0% of the total greenhouse gases emission in 2016. In the 'with existing measures' scenario, projections show a slight increase in emissions after 2020 and a stagnation and a slight decrease in emissions in 2035. The increase in emissions is due primarily to the increase in energy demand. In the 'with additional measures' scenario, projections show a stagnation and reduction of emissions in 2035.

The transport sector includes emissions from fuel combustion in road transportation, civil aviation, railways and navigation. The emission from transport sector in 2016 amounted to 6,137 kt CO<sub>2</sub>-eq, which makes about 24.9% of total Croatia's greenhouse gases emission. In the 'with existing measures' scenario in the period from 2020 to 2035, projections indicate a slight increase in emissions by 2030 and a slight decrease in emissions in 2035. Factors that encourage the growth of emissions are expected increase in economic activities and living standards, while the emission reductions are primarily affected by the measures to increase energy efficiency and use of electric energy and renewable sources in transport. Most of the existing measures have defined duration by 2020 so in this scenario not many measures are simulated after 2020. In scenario 'with additional measures', in the period from 2020 to 2035, projections show a slight increase in emissions in 2020 and a stagnation and a slight decrease in emissions in 2035, primarily due to planned measures to increase the share of rail transport and development of electric vehicles, which will be the key condition for the strong reduction of emissions in transport sector in long term.

The industry sector includes the process emission from industrial processes and product use, while emission from fuel combustion in industry is included in the Energy sector. The emission from industry sector in 2016 amounted to 2,6524kt CO<sub>2</sub>-eq, which makes about 10.2 % of total Croatia's greenhouse gases emission in 2016. Emission projections show stagnant emissions in the 'with existing measures' scenario. The implementation of procedural measures in the 'with existing measures' scenario is prescribed by sectoral legislation. Emission projections show emission reductions in the 'with additional measures' scenario due to the implementation of cost-effective emission reduction measures.

The agriculture sector covers about 10% of total greenhouse gas emissions in 2016 (emission is 2,931 kt CO<sub>2</sub>-eq). Projections indicate in both scenarios a slight continuous decline in emissions until 2035.

The waste management sector participates in the total emission of greenhouse gases with about 9.2% in 2016 (emission is 2,276 kt CO<sub>2</sub>-eq). Emission projections show emission reductions due to the implementation of cost-effective emission reduction measures. The CO<sub>2</sub> reduction potentials that can be realized by applying the measures included in the 'with existing measures' and 'with additional measures' scenarios are balanced in the Energy sector.

In the year 2016, removals by sink in the LULUCF sector were -5,422 kt CO<sub>2</sub>-eq. Projections of sinks in 2040 amount -1,767 kt CO<sub>2</sub>-eq per year. These projections are made by sectorial

sub-categories 'Forest land', 'Cropland', 'Grasslands', 'Wetlands', 'Settlements', 'Other land' and 'Harvested wood products' for the scenario with existing measures and their aggregated trend is shown in Figure 5-3.

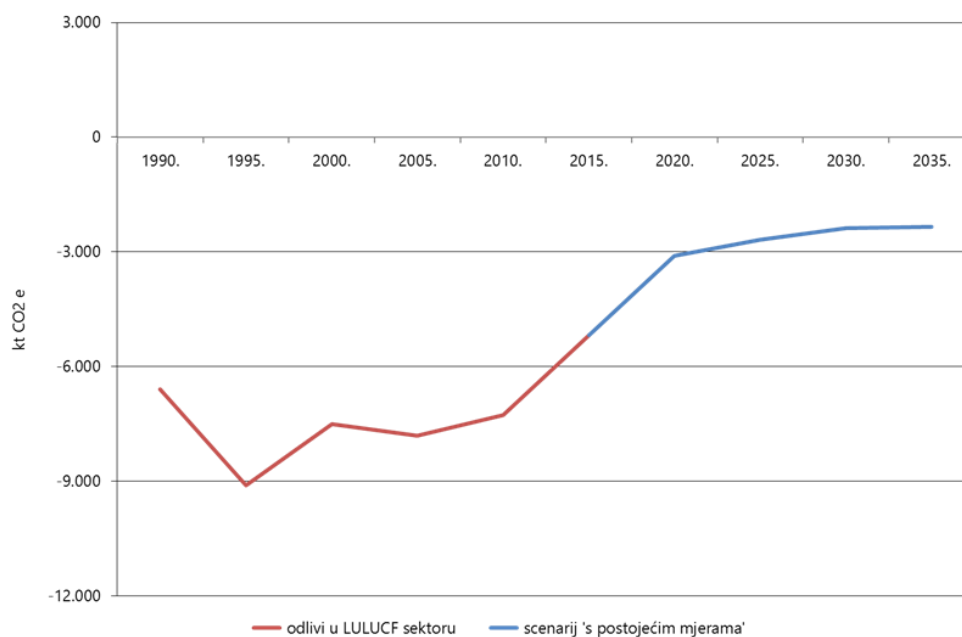


Figure 5-3: Historical and projected greenhouse removals in the LULUCF, 'with existing measures' scenario

### 5.2.2. Projections of greenhouse gas emissions by gases

Trends in emissions, by greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs and PFCs, SF<sub>6</sub>), for scenarios 'with existing measures' and 'with additional measures' in the period from 1990 until 2035 are shown in Figure 5-4.

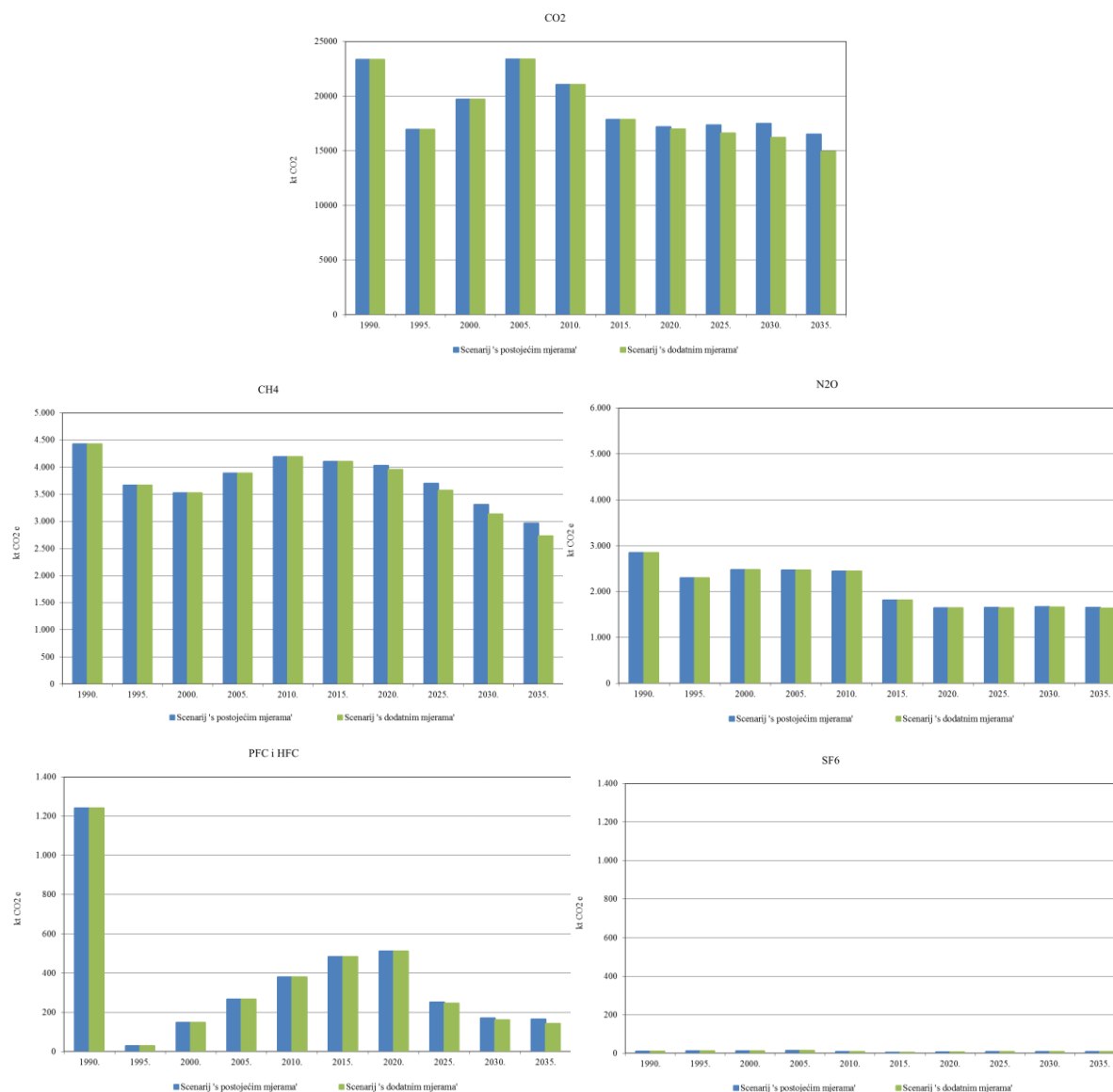


Figure 5-4: Projections of greenhouse gas emissions by gases

Historical emissions and projections of greenhouse gas emissions CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs and PFCs, SF<sub>6</sub>, for both scenarios, in the period from 1990 until 2035 are shown in Table 5-2.

Table 5-2: Historical emissions and projections of greenhouse gas emissions by gases, kt CO<sub>2</sub>e

CO <sub>2</sub>	1990.	1995.	2000.	2005.	2010.	2015.	2020.	2025.	2030.	2035.
Scenarij 's postojećim mjerama'	23.337,10	16.933,30	19.699,20	23.383,80	21.064,50	17.840,70	17.166,74	17.335,59	17.494,47	16.512,11
Scenarij 's dodatnim mjerama'	23.337,10	16.933,30	19.699,20	23.383,80	21.064,50	17.840,70	16.979,12	16.604,33	16.213,05	14.923,87
CH <sub>4</sub>	1990.	1995.	2000.	2005.	2010.	2015.	2020.	2025.	2030.	2035.
Scenarij 's postojećim mjerama'	4.423,80	3.662,50	3.523,60	3.886,60	4.191,50	4.102,70	4.026,01	3.695,50	3.310,79	2.962,03
Scenarij 's dodatnim mjerama'	4.423,80	3.662,50	3.523,60	3.886,60	4.191,50	4.102,70	3.955,18	3.570,23	3.135,81	2.731,22
N <sub>2</sub> O	1990.	1995.	2000.	2005.	2010.	2015.	2020.	2025.	2030.	2035.
Scenarij 's postojećim mjerama'	2.846,70	2.300,50	2.478,50	2.463,10	2.440,90	1.816,30	1.644,30	1.649,57	1.665,74	1.648,15
Scenarij 's dodatnim mjerama'	2.846,70	2.300,50	2.478,50	2.463,10	2.440,90	1.816,30	1.642,58	1.644,03	1.656,47	1.635,83
PFC i HFC	1990.	1995.	2000.	2005.	2010.	2015.	2020.	2025.	2030.	2035.
Scenarij 's postojećim mjerama'	1.240,20	29,30	147,90	265,80	378,90	482,50	510,85	251,37	170,28	165,41
Scenarij 's dodatnim mjerama'	1.240,20	29,30	147,90	265,80	378,90	482,50	510,85	246,45	160,98	141,60
SF <sub>6</sub>	1990.	1995.	2000.	2005.	2010.	2015.	2020.	2025.	2030.	2035.
Scenarij 's postojećim mjerama'	10,50	11,10	11,60	13,00	9,00	5,20	6,66	7,41	8,21	8,97
Scenarij 's dodatnim mjerama'	10,50	11,10	11,60	13,00	9,00	5,20	6,66	7,41	8,21	8,97
UKUPNO	1990.	1995.	2000.	2005.	2010.	2015.	2020.	2025.	2030.	2035.
Scenarij 's postojećim mjerama'	31.858,30	22.936,70	25.860,80	30.012,30	28.084,80	24.247,40	23.354,56	22.939,44	22.649,48	21.296,66
Scenarij 's dodatnim mjerama'	31.858,30	22.936,70	25.860,80	30.012,30	28.084,80	24.247,40	23.094,38	22.072,45	21.174,52	19.441,48

The energy sector has the most significant anthropogenic sources of CO<sub>2</sub> emissions, with maximum value from 16,512 kt CO<sub>2</sub> (for the 'with existing measures' scenario) to 14,924 kt CO<sub>2</sub> (for the 'with additional measures' scenario) in 2035.

The main source of CH<sub>4</sub> emission is the Waste sector. The projections for 2035 show in the 'with existing measures' scenario emissions of 2,962 kt CO<sub>2</sub>-eq and in the 'with additional measures' scenario the emissions in 2035 amount to 2,731 kt CO<sub>2</sub>-eq.

The most important source of N<sub>2</sub>O emissions is agriculture sector, which projections in 2035 have the maximum of 1,648 kt CO<sub>2</sub>-eq for the 'with existing measures' scenario, or 1,636 kt CO<sub>2</sub>-eq for the 'with additional measures' scenario.

The sources of HFCs and PFCs and SF<sub>6</sub> emissions are in the industry sector. Although their emissions in absolute terms are not large, due to the large global warming potential (GWP), their contribution is significant. Projections in 2035 have the maximum value of 165 kt CO<sub>2</sub>-eq for the 'with existing measures' scenario, 142 kt CO<sub>2</sub>-eq eq for the 'with additional measures' scenario.

### 5.2.3. Total projections of greenhouse gas emissions

Historical emissions and total projections of greenhouse gas emissions (not including removals) are shown in Figure 5-5 and **Pogreška! Izvor reference nije pronađen..** Emissions are shown for the 'with existing measures' and 'with additional measures' scenarios, for the period 1990 to 2035.

Table 5-3: Historical emissions and projections of greenhouse gas emissions by sectors, kt CO<sub>2</sub>e



Scenarij 's postojećim mjerama'	1990.	1995.	2000.	2005.	2010.	2015.	2020.	2025.	2030.	2035.
Energetika	17.849	12.666	13.752	16.034	13.795	10.652	9.507	9.686	9.745	9.280
Promet	3.881	3.368	4.499	5.562	5.952	5.952	6.242	6.294	6.358	5.772
Industrijski procesi i uporaba proizvoda	4.678	2.469	3.137	3.574	3.332	2.800	2.752	2.517	2.521	2.527
Otpad	1.051	1.169	1.339	1.518	1.911	1.964	2.151	1.775	1.420	1.157
Poljoprivreda	4.400	3.265	3.134	3.324	3.094	2.880	2.703	2.667	2.605	2.560
<b>UKUPNO</b>	<b>31.858</b>	<b>22.937</b>	<b>25.861</b>	<b>30.012</b>	<b>28.085</b>	<b>24.247</b>	<b>23.355</b>	<b>22.939</b>	<b>22.649</b>	<b>21.297</b>
Scenarij 's dodatnim mjerama'	1990.	1995.	2000.	2005.	2010.	2015.	2020.	2025.	2030.	2035.
Energetika	17.849	12.666	13.752	16.034	13.795	10.652	9.507	9.340	9.069	8.279
Promet	3.881	3.368	4.499	5.562	5.952	5.952	6.242	6.055	5.876	5.356
Industrijski procesi i uporaba proizvoda	4.678	2.469	3.137	3.574	3.332	2.800	2.564	2.354	2.367	2.289
Otpad	1.051	1.169	1.339	1.518	1.911	1.964	2.151	1.775	1.420	1.157
Poljoprivreda	4.400	3.265	3.134	3.324	3.094	2.880	2.630	2.549	2.444	2.360
<b>UKUPNO</b>	<b>31.858</b>	<b>22.937</b>	<b>25.861</b>	<b>30.012</b>	<b>28.085</b>	<b>24.247</b>	<b>23.094</b>	<b>22.072</b>	<b>21.175</b>	<b>19.441</b>

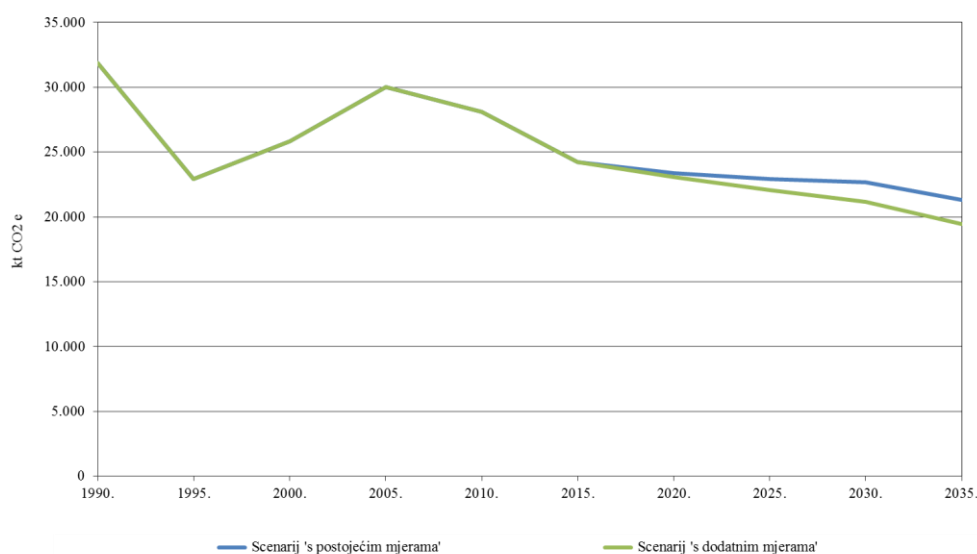


Figure 5-5: Total projections of greenhouse gas emissions (without removals) for period until 2035

The projections show that in 2035 the emissions in the 'with existing measures' scenario is decreased by 33.5% compared to 1990, while in the 'with additional measures' scenario the emissions is decreased by 39% compared to 1990.

In the 'with existing measures' scenario, projections show a reduction by 2020. After 2020, emissions in this scenario show only a slight decline. In the 'with additional measures' scenario, projections show a steady trend of reducing emissions.

In scenario 'with additional measures' in relation to the scenario 'with existing measures' in 2035, greenhouse gas emissions will be reduced by 8.7%.

#### 5.2.4. Emissions from sectors in the emission trading system (EU ETS) and sectors outside the emission trading system (ESD)

Historical emissions and projections of greenhouse gas emissions in ETS and ESD sectors for both scenarios are shown in Table 5-4.

Table 5-4: Historical emissions and projections of greenhouse gas emissions in ETS and ESD sectors, kt CO<sub>2</sub>e

	2010.	2015.	2020.	2025.	2030.	2035.
Scenarij 's postojećim mjerama'	28.085	24.247	23.355	22.939	22.649	21.297
ETS	8.710	8.386	7.463	7.452	7.448	7.095
ESD	19.375	15.861	15.892	15.488	15.201	14.201
Scenarij 's dodatnim mjerama'	28.085	24.247	23.094	22.072	21.175	19.441
ETS	8.710	8.386	7.277	7.134	6.991	6.408
ESD	19.375	15.861	15.817	14.939	14.183	13.034

Emissions within the ETS in 2016 encompassed 34% of total emissions, amounting to 8.246 kt CO<sub>2</sub>-eq. Projections indicate that in 2020 the ETS cover approximately 32% of total emissions, while in 2035, 33% of emissions will be included according to the 'with existing measures'. Under the 'with additional measures' scenario, ETS will cover 31.5% in 2020, while in 2035 it will cover 33% of emissions.

In the 'with existing measures' scenario, emission projections within the ETS show a reduction in emissions in 2020 compared to 2015. In the period from 2020 to 2035, a further slight reduction in emissions is expected in this scenario, by 15.3% in 2035 compared to 2015.

In the 'with additional measures' scenario, projections show a steady downward trend, primarily due to the planned continuation of the renewable energy and energy efficiency encouragement. Compared to 2015, projections show a 23.6% reduction in emissions in 2035.

In 2015, emissions within ESD sector amounted to 15.942 kt CO<sub>2</sub>-eq, which represents 66% of total emissions.

In the 'with existing measures' scenario, it is expected that emissions will be slightly reduced in the period from 2015 to 2035. Compared to 2005, emissions show a decrease by 17.9% in 2020, by 21.5% in 2030 and by 26.7% in 2035.

In the 'with additional measures' scenario, an additional emission reduction is expected, reducing emissions in the ESD compared to 2005 by 18.3% in 2020, 26.7% in 2030 and 32.7% in 2035.

Historical emissions and projections of greenhouse gas emissions within the ETS and within the ESD, for both scenarios, are shown in Figure 5-6 and Figure 5-7.

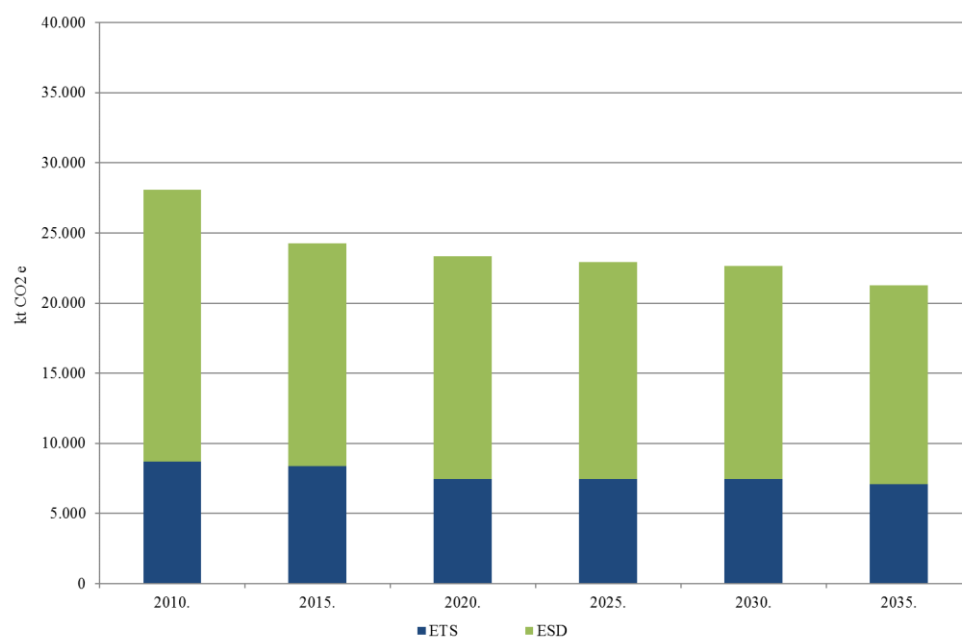


Figure 5-6: Historical emissions and projections of emissions within the ETS and ESD sectors, 'with existing measures' scenario

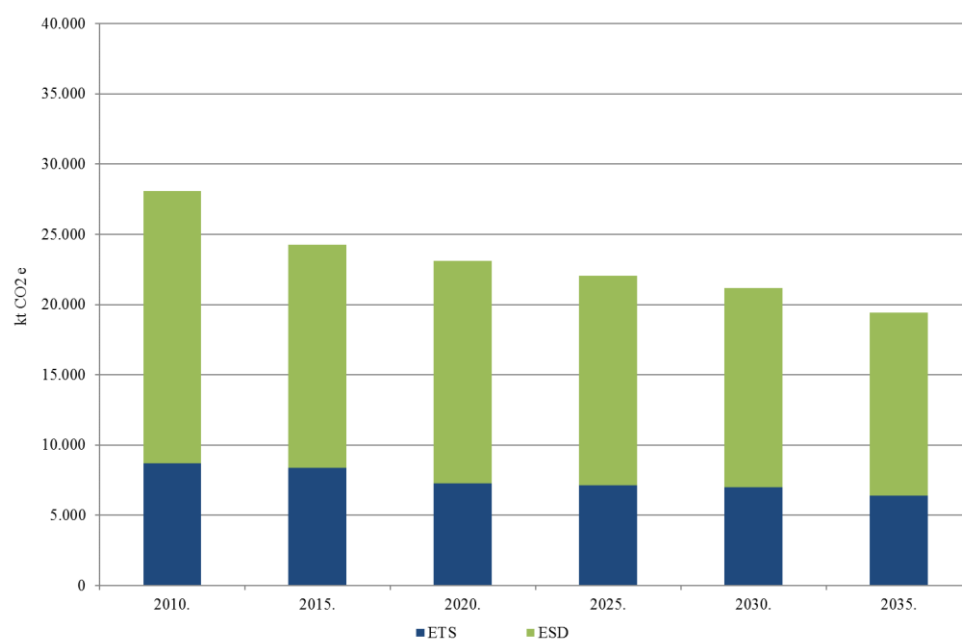


Figure 5-7: Historical emissions and projections of emissions within the ETS and ESD sectors, 'with existing measures' scenario

### 5.3. PROJECTION METHODOLOGY AND MODEL

The projections were made in accordance with the Guidelines for the national report of the Parties to Annex I to the Convention.

The potential for mitigation of national greenhouse gas emissions is analyzed and evaluated at the sectoral level. Such an assessment takes into account past trends, the present situation and future projections of parameters that determine the potential for mitigation of emissions.

The 'with existing' and 'with additional measures' scenarios include policies and measures to reduce emissions from sources and increase greenhouse gas sinks. To determine the contribution of each individual policy and measure to the emission reduction, the reduction potential is determined. In cases where the emission reduction potential of a particular policy and measure cannot be expressed separately, it is aggregated with the potential of other policies and measures.

The model and methodology used in making the projections are described by sector, below.

### 5.3.1. Energy and transport

The Model for Analysis of Energy Demand (MAED) and Model for Energy Supply Strategy Alternatives and their General Environmental Impact (MESSAGE) software packages were used in the projection calculation, in which a model for the Croatian energy sector is developed. For the purpose of detailed modelling of the development and optimization of the electric power system, a more advanced model was used, which results were integrated into the energy sector model. The results of the energy sector are integrated into the Long-Range Energy Alternatives Planning System (LEAP) software package. The model outputs are automatically adjusted according to the structure of the emission inventory under the United Nations Framework Convention on Climate Change. It is an engineering simulation model in which scenarios are simulated and certain processes and decisions optimized with respect to assumptions and limitations. The model is detailed, up to the level of individual production units, currently existing and the ones that will be running in the future.

The projections are made by 2035 on an annual basis, with increments for each year. The model is a 'bottom-up' type of model, since it starts from sectoral data and individual emission sources in the energy sector where CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions are calculated.

Assumptions for projections - energy and transport:

<b>Energy and transport</b>	
1. Direct energy consumption	<p>Direct energy consumption is projected by consumption sectors - industry, transport, services, households and agriculture, fisheries and forestry. The basis for the projections are national macroeconomic parameters. The development of technology and changing habits were taken into account in the projections of energy intensity. In the 'with existing measures' and 'with additional measures' scenarios, the impacts of each measure are modelled.</p> <p>The analyzes were carried out by sub-sectors:</p> <ul style="list-style-type: none"> <li>- industry - by industry and type of fuel used,</li> </ul>

<b>Energy and transport</b>	
	<ul style="list-style-type: none"> <li>- transport - by types of transport (road, air, ship and rail) and types of vehicles (cars, buses, motorcycles, light and heavy duty vans) or purpose (passenger and freight) and by types of technology and fuel used</li> <li>- Services - by branch (tourism, trade, education, health), climatic zones (coastal and continental Croatia), purpose (heating, domestic hot water preparation, cooking, refrigeration, electrical appliances and lighting) and by type of fuel used. The energy consumption for heating is modelled at the level of useful and immediate energy</li> <li>- households - by climatic zones (coastal and continental Croatia), by purpose (heating, CHW preparation, cooking, refrigeration, electrical appliances and lighting) and by type of fuel used. The energy consumption for heating is modelled at the level of useful and immediate energy</li> <li>- agriculture, fisheries and forestry - by type of fuel used</li> </ul> <p>Demographic trends - the assumption of a scenario of average fertility and average migration, in accordance with the population projections prepared for the purpose of drafting the Green Paper Energy Strategy: A. Akrap and K. Ivanda: Population Projections of the Republic of Croatia, 2018.</p>
<b>1.1. 'With existing measures' scenario</b>	
	<p>In the period up to 2050, the expected development based on existing measures and market progress has been simulated:</p> <ul style="list-style-type: none"> <li>- market improvements in energy efficiency and fuel replacement in the industrial sector,</li> <li>- renewal of the housing stock (reconstruction, replacement and new construction) at a rate of 0.75% of the area of the housing stock fund per year up to the near-zero energy consumption standard (including the use of renewable energy sources),</li> <li>- penetration of electric and hybrid vehicles is expected, with a share of total road passenger activity reaching 2.5% in 2030, and 30% in 2050</li> <li>- the share of rail transport in the structure of freight activity is increasing very slowly; diesel-powered N2 and N3 category trucks will continue to dominate</li> </ul>
<b>1.2. 'With additional measures' scenario</b>	
	<ul style="list-style-type: none"> <li>- Continue to promote energy efficiency beyond 2020, with the following key assumptions:</li> <li>- renovation of 1.3% of buildings annually to near-zero energy consumption standards (including the use of renewable energy sources),</li> <li>- penetration of electric and hybrid vehicles is expected, with a share of total road passenger activity reaching 3.5% in 2030, or 65% in 2050</li> <li>- incentive measures to co-finance the procurement of alternative fuel-powered vehicles until the minimum market presence of vehicles is reached. The minimum share rate will be 1 percent of the total number of vehicles registered in the country</li> <li>- Increase in the share of freight transport activity generated by rail transport (electric locomotives) to about 30% in 2050</li> </ul>

<b>Energy and transport</b>	
	<ul style="list-style-type: none"> <li>- Electrification of almost 85% of total passenger activity by 2050 is expected in urban passenger transport</li> <li>- Improvements in energy efficiency in industry together with the replacement of fuels towards greater use of renewable energy and electricity.</li> </ul>
2. Energy transformations and resources	<p>The power system was analyzed by simulating market development using hourly optimization software. The price of emission units in the EU ETS is assumed as in the EU 2016 reference scenario.</p> <p>Simulation of refinery operations was done to meet domestic demand as much as possible with existing capacity, which means without building new refineries and reducing production in 'with existing measures' and 'with additional measures' scenarios.</p>
2.1. 'With existing measures' scenario	
	<p>Assumptions:</p> <ul style="list-style-type: none"> <li>- by 2020 installed capacity of renewable energy power plants in accordance with the National Renewable Energy Action Plan by 2020 (2013) and the Tariff System for Renewable Energy Sources and Efficient Cogeneration (OG 133/2013, 151/2013, 20 / 2014, 107/2014 and 100/2015),</li> <li>- in the period after 2020, it has been simulated with software for long-term operation and construction of the electricity system on the principle of least cost or ideal market conditions. The model also includes a part of the district heating system in the large cities that is supplied from cogeneration,</li> <li>- the price of emission units is assumed as in EU Reference Scenario 2016,</li> <li>- the analysis has shown that renewables will be competitive and without the need for financial support for solar and wind farms,</li> <li>- the analysis shows that the new coal-fired power plants are not competitive as a result of the increase in the price of emission allowances and the reduction of the cost of investing in renewable energy sources,</li> <li>- the level of net electricity imports was assumed to be gradually decreasing</li> </ul>
2.2. 'With additional measures' scenario	
	<p>The assumptions include the continued development of a renewable energy incentive policy beyond 2020:</p> <ul style="list-style-type: none"> <li>- in the period after 2020, it has been simulated with software for long-term operation and construction of the electricity system on the principle of least cost or ideal market conditions. The model also includes a part of the district heating system in the large cities that is supplied from cogeneration,</li> <li>- the price of emission units is assumed as in EU Reference Scenario 2016,</li> <li>- the analysis has shown that renewables will be competitive and without the need for financial support for solar and wind farms,</li> <li>- the analysis shows that the new coal-fired power plants are not competitive as a result of the increase in the price of emission allowances and the reduction of the cost of investing in renewable energy sources,</li> <li>- the level of net electricity imports was assumed to be gradually decreasing</li> </ul>

### 5.3.2. Industrial processes and product use

An engineering simulation model derived from a spreadsheet calculation interface was used to create the projections. The model is structured according to the table structure of the United Nations Framework Convention on Climate Change's emission inventory.

The model is detailed, up to the level of individual production units, currently existing and the ones that will be running in the future.

Projections are being made by 2035, in five-year increments. The model is 'bottom-up' type, since it starts from sectoral data and individual emission sources, and CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFC, PFC and SF<sub>6</sub> emissions are calculated.

Assumptions for projections - industrial processes and product use:

Industrial processes and product use
<p><u>'With existing measures' scenario</u></p> <p>1. Industrial processes</p> <p>The projections were carried out on the basis of the expected development of individual industries, which includes targets by 2050.</p> <p>The following key assumptions are included:</p> <ul style="list-style-type: none"> <li>- Projections are based on the state and projections of macroeconomic parameters and the results of sectoral analyzes.</li> <li>- Industrial activity by industry was estimated on the basis of sectoral analyzes on planned production of individual industries and projected macroeconomic indicators on gross value added by industry.</li> <li>- The production and treatment of natural gas and liquid petroleum fuels follows domestic demand.</li> <li>- Projections of emissions from energy consumption in manufacturing and construction are broken down by sector, in accordance with the IPCC methodology. Process emissions from economic activities included in the industrial processes and product uses sector in accordance with the IPCC methodology have been estimated on the basis of detailed sectoral projections of cement, ammonia and nitric acid production and projected macroeconomic indicators of gross value added by other industries, annual gross growth rate social product and population decline.</li> <li>- The scenario involves the application of measures defined by strategic and planning sectoral documents included in the business policies of major manufacturers, which is conditioned by market requirements, laws and regulations and the requirements of applying the best available techniques in production processes.</li> <li>- The projections include assumptions that no new capacity will be installed in the industry and that production will reach maximum values by 2050.</li> <li>- Process CO<sub>2</sub> emissions also originate from NMVOC emissions that contribute to CO<sub>2</sub>eq emissions. NMVOC emission projections for the period up to 2050 are calculated on the basis of</li> </ul>

**Industrial processes and product use**

emissions from the last historical year and assuming correlation with population trends or economic growth in some categories or continuation of the trend in others<sup>10</sup>.

2. Use of alternatives to ozone damaging substances

The scenario includes the existing legal framework of the Republic of Croatia and the adopted EU legal framework in the field of use of fluorinated greenhouse gases for the period up to 2030. For the post-2030 period, assumptions have been used to implement measures that would be achieved without climate change mitigation policies, based on population projections, vehicle numbers, and expert estimates based on an analysis of a group of countries with similar national characteristics.

Assumptions on the limitation and reduction of the use of fluorinated greenhouse gases, in accordance with the provisions of Regulation (EU) No 1093/2010, are included in the development of projections. 517/2014 and Directive 2006/40 / EC:

- Limiting the amount of hydrocarbons available on the market by 2030 to 21% of the total quantity of hydrocarbons placed on the market during the reference period 2009-2012.
- Restricting the possibility of retrofitting air conditioning equipment designed to contain fluorinated greenhouse gases with a global warming potential of more than 150 in motor vehicles and prohibiting the filling of air conditioning equipment with those gases.

'With additional measures' scenario

The scenario involves the application of cost-effective measures to reduce greenhouse gas emissions from industry by industry and process emissions in cement production, and to reduce the emissions of volatile organic compounds, controlled substances and fluorinated greenhouse gases.

1. Industrial processes

Process measures to reduce greenhouse gas emissions from industrial processes:

- a gradual decrease in the share of clinker in cement production (in 2030 the share is 65% and in 2050 50%).

2. Use of alternatives to ozone depleting substances

The NU1 scenario involves a more intense reduction of fluorinated greenhouse gases available on the market after 2030, compared to the NUR scenario, in line with expert judgment based on the continuation of the trend of reduction of fluorinated greenhouse gases. The NU1 scenario includes assumptions about the number of vehicles, which is related to the reduction of fluorinated greenhouse gas emissions from mobile air-conditioning systems. Restricting the possibility of retrofitting air conditioning equipment designed to contain fluorinated greenhouse gases with a global warming potential above 150 in motor vehicles is based on expert judgment, in accordance with the analysis of a group of countries with similar national characteristics.

<sup>10</sup> In the national pollutant emission inventory, the Tier 1 methodology is used for the individual key categories of NMVOC emission sources, which does not allow for the inclusion of reduction measures. Therefore, the historical trend does not show a decrease in NMVOC emissions as a result of the application of the *Decree on the limit values for the content of volatile organic compounds in certain paints and varnishes used in construction and vehicle finishing products (OG 69/13)*. The forecast of future emission factors from 2020 assumes the implementation of reduction measures, and for the other future years until 2050 a conservative approach is applied, which means the further implementation of measures assuming that the emission factors will remain constant.



### 5.3.3. Agriculture

The model derived from the spreadsheet calculation interface was used to create the projections. The model is structured according to the table structure of the United Nations Framework Convention on Climate Change's emission inventory. It is an engineering simulation model.

The model is detailed, down to the level of individual sources, existing and future.

Projections are being made by 2020, indicative by 2035, in five years increments. The model is a 'bottom-up' type, since it starts from sectoral data and individual emission sources, and CH<sub>4</sub> and N<sub>2</sub>O emissions are calculated.

Assumptions for projections - agriculture:

<b>Agriculture</b>
<p><u>'With existing measures' scenario</u></p> <p>The approach to the emission trend was used to formulate the scenario, which implies a further fall in emissions from the agricultural sector, mainly due to a decrease in livestock stock and a slight decline in crop production. The established emission projection model was set using the following assumptions:</p> <ul style="list-style-type: none"> <li>- Input data projection trends on livestock and plant production activities were taken from the global FAO report "The Future of Food and Agriculture - Alternative Roads to 2050", using the BAU (business as usual) scenario of the said report.</li> <li>- Use of mineral fertilizers obtained by extrapolation of the current trend for the period from 2000 to 2016.</li> <li>- Implementation of the rural development program 2014-2020.</li> <li>- Minor changes in the livestock farming system and diet (changes in the system of fertilization and genetic progress, increase in digestibility and quality of feed).</li> </ul> <p>Based on the above presented policies and measures, the scenario retains the application of mineral fertilizers (nitrogen) to the soil at the level resulting from the trend of mineral fertilizer consumption in the period 2000 to 2017, ie assumes that there will be no increase in mineral fertilizer consumption despite estimated changes in plant production and livestock production. For the purpose of detailed modelling of nitrogen applied, it is necessary to establish a system for real monitoring of the consumption of mineral fertilizers on holdings, as well as estimates of the share of agricultural land under individual crops at the national level as part of the preparation of soil maps and the study of the possibility of applying measures to reduce greenhouse gas emissions in the agriculture sector.</p> <p><u>'With additional measures' scenario</u></p> <p>The positive impact of the application of measures on total greenhouse gas emissions in the agricultural sector is reflected in the direct reduction of methane and nitrogen compounds. Measures involved in the formation of the NU1 agriculture scenario in relation to the NUR scenario:</p> <ul style="list-style-type: none"> <li>- Changing the diet of cattle and pigs and the quality of fodder</li> <li>- Anaerobic digestion of manure and biogas production</li> <li>- Improvement of facilities or housing as well as manure management systems</li> </ul>

**Agriculture**

- Improvement of the application of mineral fertilizers
- Hydromelioration interventions and systems for protection against disasters
- Introducing new cultivars, varieties and crops.

In order to assess the potential reduction of total emissions through the increase of soil organic carbon by applying an additional set of measures, it is necessary to carry out national surveys in order to define the real potential for carbon sinks in agricultural soils in the Republic of Croatia, in particular the relationship of the reduced tillage system with respect to fertilization recommendations, and continue exploring the potential for application depending on the breeding culture. Measures that have the potential to increase carbon sequestration:

- Improvement and change of soil tillage system (reduced tillage)
- Extension of rows with a higher proportion of legumes
- Intensification of crop rotation using intermediate axes
- Improving the way organic fertilizers are applied
- Agroforestry.

**5.3.4. Waste**

An engineering simulation model derived from the calculating interface was used to create the projections. The model is structured according to the table structure of the United Nations Framework Convention on Climate Change's emission inventory.

The model is detailed, down to the level of individual sources, existing and future.

Projections are being made by 2035, in five-year increments. The model is of the 'bottom-up' type because it is based on sectoral data and individual emission sources, with CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions calculated.

**Assumptions for projections - waste:****Waste**'With existing measures' scenario:

The scenario includes the existing legal frameworks of the Republic of Croatia and the adopted EU legal framework in the field of waste management for the period up to 2035. A delay of 5 years for the Republic of Croatia is included in the projections. For the post-2040 period, assumptions were used to apply the measure based on expert judgment, the corresponding assumptions defined in the adopted planning documents.

The scenario involves projections of emissions from the activities of disposal, biological treatment and incineration of solid waste and wastewater management. The projections were carried out on the basis of the expected development and the future state of the parameters for the production of projections - the amount of produced and disposed solid waste (municipal, production, sewage sludge), the share of the organic part of solid waste, the share of recovered/burned methane and the amount of composted organic waste. Emission projections are based on 2018 macroeconomic parameter projections - an annual rate of increase in gross domestic product and a decrease in population.

Projections include the following assumptions:

**Waste**

- Solid Waste Disposal - Reduction in the amount of solid waste produced and disposed of due to the application of measures defined by sectoral legislation in line with EU legislation. On July 4, 2018, new EU rules came into force with legally binding targets for waste recycling and waste disposal. Croatia has been given the option of a five-year delay in meeting these targets, as it has recycled less than 20% of municipal waste in 2013 or dumped more than 60% in landfills among Member States. A 5 year delay is included in the projections.
- Composting - a continuous increase in the amount of waste treated by composting due to the application of measures defined by sectoral legislation in line with EU legislation. The increase in the amount of waste that will be composted depends on the reduction of the amount of landfilled biodegradable waste and the proportion of biodegradable waste that will be treated by composting and digestion.
- Waste incineration - No longer incineration of hospital waste without energy recovery.
- Wastewater management - continuous increase of the amount of treated wastewater of the industry and reduction of the amount of treated wastewater of households and the number of inhabitants with an individual system of wastewater treatment (septic tanks).

'With additional measures' scenario

The scenario with additional measures is identical to the scenario with existing measures since no additional emission reduction measures have been identified. A comparative analysis of a group of countries with similar national characteristics found that national legislation, which is in line with EU legislation, prescribes the measures that all Member States must implement by the deadline and considers them under the scenario of measures.

**5.3.5. LULUCF**

In the 'with existing measures' scenario, the Projection Guidelines (A: General Guidelines and B: Sector Guidelines) were used for all sectoral components. Most of the sub-categories of this sector in the Croatian Greenhouse Gas Inventory Report for 2018 are identified as key categories, either by trend or by level. Those are:

- 4 (III). Direct N<sub>2</sub>O emissions due to nitrogen mineralization
- 4.A.1 Forest land that remains forest land
- 4.A.2 Land converted to forest land
- 4.B.1 Crops/crops which remain crops/crops
- 4.B.2 Land converted to Land under crops/crops
- 4.C.2 Land converted to Lawns
- 4.D.2 Land converted to Wetland
- 4.E.2 Land converted to populated areas
- 4.G Wood products

If possible, it is recommended that Tier 2 or Tier 3 are used for the projection calculation. Due to the currently insufficient capacity in the projection system for the LULUCF sector of the Republic of Croatia, Tier 1 was applied. Emissions and sinks are calculated as the

multiplication of projected activity data and implied emission factor based on the historical series for the period 2007-2016, for each repository (aboveground and underground biomass/phytomatter, and soil). Alternative 1 was used, where activity data for the period from 2020 to 2040, in this case the area of each subcategory of land, were obtained by applying a trend extrapolation (or averages backwards, for example for Wetland) over the past ten years from 2007 to 2016. Projections for the phytomatter storage sites in the category Forest land that remains forest land, used the data on exchange annual growth rate and the planned estate from the Forest Management Basis for the period from 2016 to 2025. For the Wood Products store, the reference historical period underlying the projections was 2000-2009, due to significant deviations in statistical input data for recent years. Correction of activity data for the period 2012-2016 was carried out to avoid inconsistencies in the timetable of timber production. In cases where extrapolated values have taken unrealistically extreme values, the arithmetic mean of activity data for the past ten years ('Land converted to Lawns') or expert judgment predicting the annual volume of afforestation ('Land converted to forest land') was used. All storage calculated in NIR 2018 has been considered in the design of emissions and sink projections. Some repositories (eg dead wood for 'Forest land remaining forested') have been omitted from projections due to insufficient budget data (identical to NIR 2018). In the coming period the Republic of Croatia plans significant improvements in the projection calculation of GHG emissions and sinks. The main steps in this direction are planning of projects and activities that should be directed towards modeling projection calculations for the key subcategories of the sector and their repositories. The results aim to reduce budget uncertainty and the future application of second tier methodology (Tier 2).

#### Assumptions for projections - LULUCF:

<b>LULUCF</b>
<p>The projections were carried out on the basis of the expected future state of the parameters that determine the potential to mitigate the emission.</p> <p>Key projection parameters were determined based on projections based on the relevant Projection Guidelines (land area of each subcategory, assumed emission factors by storage) and expert estimates for areas converted to Forest Land.</p> <p>Assumptions:</p> <p>The area of total 'Forest Land' and 'Settlements' will increase</p> <p>Transformation into forest land will be maintained at the same annual level (1.88 ka/yr)</p> <p>The area of 'Wetland' will not increase</p> <p>There will be no increase in burned areas.</p>

Annex I Table 5 summarizes the key variables and assumptions used for the projections, while Table 6 (a) and 6 (c) provide information on projections of greenhouse gas emissions in the 'with measures' scenario and in the 'with additional measures' scenario.

## 5.4.PROJECT SENSITIVITY ANALYSIS

This chapter analyzes the sensitivity of projections to several selected sizes, which largely determine the uncertainty of the calculation. Sensitivity will be commented on qualitatively and where possible quantitatively. The impact was observed:

- rates of economic development,
- the influence of temperature change on heating and cooling energy,
- hydrology in electricity production of hydroelectric power plants,
- agricultural development.

The influence of a certain factor can be significant from the point of view of the emission trend and/or from the point of view of variability around the mean. The trend is for longer duration sequences, while variability is for one or several years.

The emission is calculated as the product of the activity and the emission factor. Some factors influence activity more, such as fuel consumption, kilometres travelled, number of livestock, etc. Others influence emissions factors more, eg tCO<sub>2</sub>/MWh, tN<sub>2</sub>O/km, etc. Emission dependence on starting values is mostly linear type, with some values having an impact across many sectors, which is discussed below.

#### **5.4.1. Economic development rate (GDP rate and demographic trends)**

The rate of economic development has an impact on all sectors, more on activities and relatively less on emission factors. The impact on emission factors is reflected over the long term, so, for example, reduced economic potential will result in less technological progress in the long run, and this is reflected in the budget through emission factors. Croatia has relatively low emissions, so individual disturbances can have a strong impact on overall emissions. The period of war, the transition to a market economy, the economic crisis, are powerful factors that make it impossible to establish reliable correlation relationships from the historical data set. It is assumed in the emissions projections that energy consumption will grow with GDP, but the correlation between GDP and energy consumption will decrease.

Regulation (EU) 2018/1999 recommends that national assumptions and baselines used for EU common projections should be used for national scenarios as far as reasonably practicable. In June 2018, the EC drafted Recommended Harmonized Parameters for the Design of National Projections, Integrated Plans and Long-Term Strategies<sup>11</sup>. Recommended parameters include projections of demographic development, GDP rates, gross value added of individual industries, fuel price projections and emission units. In case of deviation, ie not using the recommended parameters, it is necessary to make a sensitivity analysis and determine changes in greenhouse gas emissions.

In the sensitivity analysis, key differences in the baseline data of the national scenarios and the baseline data used by the EU in the common scenarios have been identified and differences in greenhouse gas emissions will be outlined below.

##### GDP rate

In the scenarios analyzed, GDP growth is assumed to average 2.0% per year by 2030.

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<sup>11</sup> Recommended parameters for reporting on GHG projections in 2019, EC

Recommended GDP growth rates assume GDP growth by 2030, an average of 1.7%.

Using the recommended GDP growth rates, emissions could be around 1.2% lower in both scenarios in 2030, assuming equal carbon intensity for the economy. However, the implementation of emission reduction measures reduces, and in the long run, disconnects between GDP and emissions. Thus, GDP growth contributes to reducing emissions when it comes through investments in low-carbon technologies, industries and services.

#### Demographic trends

The scenarios analyzed assume a demographic scenario with a population of 3,755,419 in 2030. The recommended demographic projection parameters give 8.7% more population in 2030.

In low-carbon scenarios, GDP is separated from greenhouse gas emissions and per capita emissions are falling. In the 'with additional measures' scenario, in 2030 the emission is 5.6 tCO<sub>2</sub>e/apartment. Variations in demographic trends have a declining impact on emissions and cannot substantially change the set trends.

Using the recommended demographic parameters, emissions could be around 4% higher in 2030 compared to the 'with additional measures' scenario presented.

### **5.4.2. Influence of temperature change on heating and cooling energy**

Temperature change will reduce the need for heating, but on the other hand will increase the need for cooling. The goal of climate policy is to keep global temperature rise within 2 °C. Since the measurements have been carried out in the Republic of Croatia, the temperature rise has been determined. This is estimated to increase by about 1 °C to 2050.

#### Heating fuel needs

In most cases, the interior design temperature in buildings is 20 °C, but in reality the temperatures of the heated spaces are maintained at temperatures up to 24 °C. With these assumptions, the reduction of the required heat for heating in the continental part of the Republic of Croatia could be between 7.7 and 11.3%, and in the coastal part of Croatia between 12.7 and 24.2%.

#### Refrigeration needs

In contrast to the need for heating, there is no such pronounced dependence of the need for comfortable cooling on the outside air temperature, since the influence of thermal gains due to solar radiation is dominant here. At this point in time, the available data cannot provide an estimate of the effect of changes in outside temperature on cooling needs. It can only be estimated that the impact will be less pronounced than is the case for heating needs.

#### Other impacts on energy

Changes in temperature, precipitation and wind energy will affect the production of renewable energy. These impacts need to be quantified and incorporated into operational planning, especially at regional and local level where large differences are possible.

### **5.4.3. Hydrology in electricity production of hydroelectric power plants**

Depending on the hydrology, production from large hydropower plants varies from 4 TWh to 8 TWh. This is from 20 to 40% of the total electricity production in the Republic of Croatia. The cycles of dry and humid years can last for several years, and in this regard the emissions of the electricity sector can vary considerably.

The lack of production from hydropower plants is compounded by increased production from thermal power plants or increased imports. In the extreme case of drought, the increase in emissions could be in 2030, in the 'with additional measures' scenario, about 4.2% of Croatia's total emissions.

### **5.4.4. Development of agriculture**

Small farms are characteristic of agriculture in Croatia. The average family farm is only 2 acres in size. According to the 2003 Inventory of Agriculture, only 20% of cultivated land is privately owned, with an average of 159 acres. The situation is similar in the cattle sector: 96% of all dairy farmers own only 15 cows, while 90% of pigs are in 200,000 small holdings, with 170,000 holdings holding less than 10 pigs. Such fragmentation and old populations inhibit faster development. Agriculture will therefore change slowly, which will present a challenge in terms of emissions.

## **6. PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY BUILDING SUPPORT TO DEVELOPING COUNTRIES**

The Act on Air Protection (OG 130/11, 47/14, 61/17, 118/18) stipulates the use of revenues from the greenhouse gas emissions auctioning, including the financing of mitigation measures for climate change and adaptation in third countries. By the decision on the adoption of the Plan for the use of financial resources obtained from the sale of auctioning revenues in the Republic of Croatia by 2020 (OG 19/18, 84/19), funds for financing projects in third countries are planned.

The plan for the use of funds obtained from the sale of emission units through auctions in the Republic of Croatia until 2020 defines financing Government to Government (G2G) for the projects with third countries and other appropriate bilateral programs and payments to the Green Climate Fund and similar funds under the Convention, intended to mitigate and adapt to climate change.

In accordance with the Plan for the use of auctioning revenues in the Republic of Croatia by 2020, the Bilateral Assistance Program for Third Countries in the Area of Climate Change for the period 2018-2020 is being drafted, and its adoption is planned during 2020.

As an Annex I country, the Republic of Croatia has so far not carried out separate activities related to financing the transfer of knowledge and technology in the field of environmental protection to developing countries.



## 7. ANNEX I - CTF tables

### CTF Table 1 Emission trends (kt CO<sub>2</sub>e)

Table 1

HRV\_BR4\_v0.1

**Emission trends: summary****(Sheet 1 of 3)**

<i>GREENHOUSE GAS EMISSIONS</i>	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	<i>kt CO<sub>2</sub> eq</i>									
CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	23,337.10	23,337.10	17,189.18	16,512.51	16,965.91	16,225.05	16,933.29	17,524.23	18,585.64	19,289.61
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	16,648.52	16,648.52	9,285.27	8,477.11	8,650.88	7,666.33	7,824.44	8,757.45	10,347.12	11,288.61
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	4,423.83	4,423.83	4,289.86	3,858.83	3,926.63	3,715.84	3,662.49	3,654.99	3,603.05	3,568.73
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	4,425.06	4,425.06	4,293.05	3,873.98	3,961.02	3,727.35	3,670.03	3,671.52	3,620.67	3,613.84
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	2,846.74	2,846.74	2,697.87	2,732.40	2,353.00	2,386.48	2,300.53	2,305.86	2,492.97	2,137.92
N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	2,879.51	2,879.51	2,732.16	2,775.36	2,408.89	2,427.15	2,338.67	2,350.51	2,538.52	2,203.46
HFCs	NO	NO	NO	NO	NO	NO	29.32	49.77	71.93	101.88
PFCs	1,240.24	1,240.24	850.75	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF <sub>6</sub>	10.45	10.45	10.33	10.42	10.53	10.64	11.12	11.57	11.43	11.99
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (without LULUCF)</b>	31,858.36	31,858.36	25,038.00	23,114.15	23,256.07	22,338.02	22,936.75	23,546.42	24,765.02	25,110.13
<b>Total (with LULUCF)</b>	25,203.78	25,203.78	17,171.56	15,136.87	15,031.32	13,831.47	13,873.58	14,840.82	16,589.67	17,219.78
<b>Total (without LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

<i>GREENHOUSE GAS SOURCE AND SINK CATEGORIES</i>	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	<i>kt CO<sub>2</sub> eq</i>									
1. Energy	21,729.73	21,729.73	16,155.99	15,314.50	16,135.00	15,127.95	16,033.75	16,683.66	17,519.96	18,337.72
2. Industrial processes and product use	4,677.54	4,677.54	3,539.46	2,925.37	2,401.99	2,656.48	2,468.78	2,459.25	2,685.96	2,431.09
3. Agriculture	4,399.65	4,399.65	4,271.32	3,780.70	3,604.36	3,409.90	3,265.24	3,217.51	3,337.57	3,094.47
4. Land Use, Land-Use Change and Forestry <sup>b</sup>	-6,654.58	-6,654.58	-7,866.44	-7,977.28	-8,224.75	-8,506.55	-9,063.17	-8,705.60	-8,175.36	-7,890.35
5. Waste	1,051.44	1,051.44	1,071.23	1,093.58	1,114.71	1,143.70	1,168.98	1,186.01	1,221.54	1,246.85
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (including LULUCF)</b>	25,203.78	25,203.78	17,171.56	15,136.87	15,031.32	13,831.47	13,873.58	14,840.82	16,589.67	17,219.78

CTF Table 1 Emission trends (kt CO<sub>2</sub>e), cont.

Table 1

HRV\_BR4\_v0.1

**Emission trends: summary**  
**(Sheet 2 of 3)**

<i>GREENHOUSE GAS EMISSIONS</i>	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	20,127.14	19,699.20	20,817.11	21,925.19	23,277.56	22,924.76	23,383.84	23,602.90	24,918.96	23,659.86	21,848.88
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	11,499.71	12,533.66	12,865.74	13,712.08	15,860.28	15,288.04	15,540.05	15,980.51	18,018.91	16,357.70	14,607.88
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	3,588.44	3,523.63	3,610.91	3,615.35	3,752.66	3,928.07	3,886.56	4,001.48	4,001.37	4,006.54	4,099.42
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	3,594.35	3,620.54	3,629.91	3,621.75	3,792.21	3,930.99	3,889.29	4,007.54	4,033.13	4,016.12	4,104.52
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	2,363.02	2,478.52	2,455.08	2,357.42	2,260.47	2,521.13	2,463.11	2,484.17	2,533.45	2,832.95	2,198.73
N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	2,401.35	2,580.50	2,510.35	2,411.06	2,344.85	2,587.82	2,537.11	2,567.97	2,635.12	2,919.66	2,282.41
HFCs	122.08	147.90	161.46	185.34	212.23	240.33	265.80	292.57	326.74	338.04	341.35
PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.26
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SF <sub>6</sub>	11.99	11.62	11.69	12.01	12.28	12.57	13.03	13.01	13.05	11.98	8.03
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (without LULUCF)</b>	26,212.68	25,860.88	27,056.25	28,095.30	29,515.19	29,626.85	30,012.33	30,394.12	31,793.57	30,849.37	28,496.68
<b>Total (with LULUCF)</b>	17,629.49	18,894.21	19,179.14	19,942.22	22,221.85	22,059.74	22,245.27	22,861.59	25,026.95	23,643.49	21,344.44
<b>Total (without LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

<i>GREENHOUSE GAS SOURCE AND SINK CATEGORIES</i>	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Energy	18,889.81	18,250.94	19,280.86	20,381.14	21,780.88	21,236.47	21,595.82	21,663.54	22,902.01	21,721.06	20,558.06
2. Industrial processes and product use	2,850.19	3,137.01	3,133.84	3,110.85	3,136.84	3,497.99	3,574.01	3,736.83	3,909.12	3,832.55	3,085.10
3. Agriculture	3,179.44	3,133.54	3,277.27	3,191.94	3,140.60	3,376.25	3,324.11	3,377.63	3,275.23	3,494.54	3,000.88
4. Land Use, Land-Use Change and Forestry <sup>b</sup>	-8,583.19	-6,966.66	-7,877.11	-8,153.08	-7,293.35	-7,567.11	-7,767.06	-7,532.53	-6,766.62	-7,205.88	-7,152.24
5. Waste	1,293.24	1,339.39	1,364.28	1,411.37	1,456.87	1,516.13	1,518.40	1,616.13	1,707.21	1,801.22	1,852.63
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total (including LULUCF)</b>	17,629.49	18,894.21	19,179.14	19,942.22	22,221.85	22,059.74	22,245.27	22,861.59	25,026.95	23,643.49	21,344.44

CTF Table 1 Emission trends (kt CO<sub>2</sub>e), cont.

Table 1

HRV\_BR4\_v0.1

**Emission trends: summary**  
**(Sheet 3 of 3)**

<i>GREENHOUSE GAS EMISSIONS</i>	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	<i>(%)</i>								
CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF	21,064.49	20,699.04	19,115.87	18,454.66	17,708.13	17,840.71	18,082.53	18,716.77	-19.80
CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF	13,864.78	14,566.52	13,323.08	11,968.74	11,178.39	12,301.70	12,442.81	13,751.31	-17.40
CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF	4,191.48	4,178.93	4,105.17	3,918.13	3,928.10	4,102.65	4,223.52	4,108.25	-7.13
CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF	4,193.24	4,197.56	4,144.05	3,920.06	3,928.42	4,116.62	4,232.44	4,177.49	-5.59
N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF	2,440.89	2,505.39	2,288.22	1,706.52	1,644.97	1,816.34	1,588.86	1,699.63	-40.30
N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF	2,522.53	2,599.62	2,395.55	1,788.51	1,725.78	1,906.85	1,676.03	1,829.27	-36.47
HFCs	378.87	396.20	397.28	469.19	474.76	482.50	483.53	488.71	100.00
PFCs	0.03	0.02	0.03	NO	NO	NO	NO	NO	
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	0.00
SF <sub>6</sub>	8.95	9.37	9.18	6.05	6.77	5.22	6.39	6.39	-38.84
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Total (without LULUCF)</b>	28,084.72	27,788.93	25,915.74	24,554.54	23,762.73	24,247.42	24,384.83	25,019.75	-21.47
<b>Total (with LULUCF)</b>	20,968.42	21,769.28	20,269.17	18,152.55	17,314.12	18,812.88	18,841.20	20,253.17	-19.64
<b>Total (without LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>Total (with LULUCF, with indirect)</b>	NA	NA	NA	NA	NA	NA	NA	NA	0.00

<i>GREENHOUSE GAS SOURCE AND SINK CATEGORIES</i>	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	<i>(%)</i>								
1. Energy	19,747.16	19,486.70	18,060.45	17,304.81	16,364.01	16,603.97	16,966.52	17,349.21	-20.16
2. Industrial processes and product use	3,332.37	3,171.01	2,879.29	2,638.50	2,775.64	2,800.14	2,493.59	2,731.53	-41.60
3. Agriculture	3,094.31	3,189.36	3,034.88	2,786.31	2,702.19	2,879.62	2,816.92	2,844.64	-35.34
4. Land Use, Land-Use Change and Forestry <sup>b</sup>	-7,116.31	-6,019.65	-5,646.57	-6,401.99	-6,448.61	-5,434.54	-5,543.63	-4,766.58	-28.37
5. Waste	1,910.88	1,941.87	1,941.11	1,824.92	1,920.89	1,963.69	2,107.80	2,094.36	99.19
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Total (including LULUCF)</b>	20,968.42	21,769.28	20,269.17	18,152.55	17,314.12	18,812.88	18,841.20	20,253.17	-19.64

CTF Table 1(a) Emission trend (CO<sub>2</sub>)

Table 1(a)

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Emission trends (CO<sub>2</sub>)  
(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
<b>1. Energy</b>	20,656.68	20,656.68	15,164.22	14,437.67	15,213.61	14,277.28	15,175.22	15,743.63	16,616.78	17,463.39
A. Fuel combustion (sectoral approach)	20,056.11	20,056.11	14,570.70	13,833.95	14,408.69	13,555.89	14,321.54	14,917.08	15,838.80	16,771.64
1. Energy industries	7,048.59	7,048.59	4,722.56	5,382.10	5,903.57	4,614.80	5,217.28	5,041.66	5,538.02	6,192.08
2. Manufacturing industries and construction	5,501.67	5,501.67	3,919.00	3,114.89	3,031.80	3,202.34	2,954.66	2,998.35	3,026.43	3,313.18
3. Transport	3,786.94	3,786.94	2,866.87	2,776.67	2,925.04	3,102.80	3,292.78	3,620.09	3,965.98	4,098.64
4. Other sectors	3,718.91	3,718.91	3,062.28	2,560.29	2,548.29	2,635.95	2,856.82	3,256.98	3,308.37	3,167.75
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE
B. Fugitive emissions from fuels	600.56	600.56	593.52	603.73	804.92	721.38	853.68	826.55	777.98	691.74
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	600.56	600.56	593.52	603.73	804.92	721.38	853.68	826.55	777.98	691.74
C. CO <sub>2</sub> transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>2. Industrial processes</b>	2,629.87	2,629.87	1,973.47	2,008.79	1,699.63	1,899.67	1,711.24	1,727.62	1,898.65	1,778.27
A. Mineral industry	1,310.39	1,310.39	869.65	944.78	806.34	973.52	755.30	841.55	965.17	1,030.71
B. Chemical industry	751.10	751.10	665.95	832.68	715.96	715.58	756.00	701.63	743.07	592.72
C. Metal industry	336.40	336.40	270.10	121.11	57.46	81.17	40.32	19.17	40.82	29.65
D. Non-energy products from fuels and solvent use	231.98	231.98	167.78	110.21	119.86	129.39	159.63	165.28	149.59	125.18
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Agriculture</b>	50.02	50.02	50.95	65.51	52.14	47.57	46.29	52.44	68.39	44.25
A. Enteric fermentation										
B. Manure management										
C. Rice cultivation										
D. Agricultural soils										
E. Prescribed burning of savannas										
F. Field burning of agricultural residues										
G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Urea application	50.02	50.02	50.95	65.51	52.14	47.57	46.29	52.44	68.39	44.25
I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>4. Land Use, Land-Use Change and Forestry</b>	-6,688.57	-6,688.57	-7,903.91	-8,035.39	-8,315.03	-8,558.72	-9,108.85	-8,766.78	-8,238.52	-8,001.00
A. Forest land	-6,717.75	-6,717.75	-8,480.77	-8,716.86	-8,770.41	-8,896.40	-9,409.59	-9,123.16	-8,535.50	-8,207.84
B. Cropland	220.04	220.04	207.17	214.57	202.80	218.89	224.64	222.11	239.60	252.79
C. Grassland	-101.85	-101.85	-73.17	-80.46	-83.81	-92.04	-98.07	-103.24	-112.73	-117.81
D. Wetlands	46.78	46.78	46.86	46.88	46.89	46.91	46.92	46.94	46.96	46.97
E. Settlements	165.75	165.75	173.62	175.94	178.26	180.33	182.84	185.22	185.97	190.05
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products	-301.54	-301.54	222.39	324.54	111.24	-16.42	-55.59	5.35	-62.82	-165.16
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	1.82	3.70
A. Solid waste disposal	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
B. Biological treatment of solid waste										
C. Incineration and open burning of waste	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	1.82	3.70
D. Waste water treatment and discharge										
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Memo items:</b>										
<b>International bunkers</b>	643.85	643.85	94.29	72.29	182.30	403.81	348.25	314.02	310.14	336.44
Aviation	496.62	496.62	94.29	72.29	182.30	264.02	245.16	223.16	235.74	254.59
Navigation	147.23	147.23	NO	NO	NO	139.78	103.08	90.86	74.41	81.85
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	C	C
<b>CO<sub>2</sub> emissions from biomass</b>	5,126.24	5,126.24	5,986.51	5,219.31	5,493.15	4,929.23	5,212.59	5,801.38	5,428.42	5,442.75
<b>CO<sub>2</sub> captured</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Long-term storage of C in waste disposal sites</b>	1,717.23	1,717.23	1,791.71	1,866.54	1,941.87	2,018.60	2,097.00	2,176.21	2,256.77	2,338.23
<b>Indirect N<sub>2</sub>O</b>										
<b>Indirect CO<sub>2</sub> (3)</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
<b>Total CO<sub>2</sub> equivalent emissions without land use, land-use change and forestry</b>	23,337.10	23,337.10	17,189.18	16,512.51	16,965.91	16,225.05	16,933.29	17,524.23	18,585.64	19,289.61
<b>Total CO<sub>2</sub> equivalent emissions with land use, land-use change and forestry</b>	16,648.52	16,648.52	9,285.27	8,477.11	8,650.88	7,666.33	7,824.44	8,757.45	10,347.12	11,288.61
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, without land use, land-use change and forestry</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, with land use, land-use change and forestry</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

CTF Table 1(a) Emission trend (CO<sub>2</sub>), cont.

Table 1(a)

HRV\_BR4\_v0.1

Emission trends (CO<sub>2</sub>)  
(Sheet 2 of 3)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<i>GREENHOUSE GAS SOURCE AND SINK CATEGORIES</i>											
<b>1. Energy</b>	17,984.69	17,385.42	18,376.94	19,530.51	20,865.01	20,291.96	20,676.93	20,756.61	21,990.82	20,826.46	19,665.24
A. Fuel combustion (sectoral approach)	17,308.72	16,659.08	17,596.49	18,734.85	20,116.28	19,494.03	19,899.40	19,965.94	21,236.90	20,164.80	19,066.76
1. Energy industries	6,420.48	5,783.35	6,343.85	7,225.52	7,900.31	6,784.01	6,810.03	6,631.42	7,815.15	6,771.62	6,365.42
2. Manufacturing industries and construction	2,980.25	3,103.13	3,196.99	3,057.13	3,136.78	3,583.00	3,723.73	3,855.12	3,853.05	3,872.78	3,157.36
3. Transport	4,329.03	4,354.24	4,419.92	4,729.16	5,126.60	5,262.05	5,467.52	5,820.73	6,241.46	6,078.62	6,089.63
4. Other sectors	3,578.95	3,418.37	3,635.73	3,723.03	3,952.60	3,864.98	3,898.12	3,658.66	3,327.24	3,441.78	3,454.34
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE
B. Fugitive emissions from fuels	675.98	726.33	780.45	795.66	748.73	797.93	777.53	790.67	753.92	661.66	598.48
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	675.98	726.33	780.45	795.66	748.73	797.93	777.53	790.67	753.92	661.66	598.48
C. CO <sub>2</sub> transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>2. Industrial processes</b>	2,087.58	2,246.77	2,341.39	2,310.15	2,339.95	2,556.51	2,621.29	2,764.89	2,838.16	2,736.13	2,106.52
A. Mineral industry	1,287.07	1,441.95	1,663.37	1,665.34	1,668.68	1,768.72	1,833.69	1,969.73	1,999.27	1,908.84	1,475.91
B. Chemical industry	701.41	700.99	595.81	550.89	574.42	665.57	663.60	657.88	696.32	676.64	529.27
C. Metal industry	27.67	29.68	7.15	4.72	6.62	13.72	12.71	13.31	13.69	23.41	4.84
D. Non-energy products from fuels and solvent use	71.43	74.15	75.06	89.19	90.22	108.50	111.29	123.96	128.89	127.24	96.50
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Agriculture</b>	50.49	60.87	92.09	80.76	71.79	75.94	85.46	80.67	89.32	96.60	76.96
A. Enteric fermentation											
B. Manure management											
C. Rice cultivation											
D. Agricultural soils											
E. Prescribed burning of savannas											
F. Field burning of agricultural residues											
G. Liming	NO	NO	NO	NO	NO	NO	14.49	17.48	16.60	20.78	11.92
H. Urea application	50.49	60.87	92.09	80.76	71.79	75.94	70.97	63.19	72.72	75.83	65.04
I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>4. Land Use, Land-Use Change and Forestry</b>	-8,627.43	-7,165.55	-7,951.37	-8,213.11	-7,417.28	-7,636.72	-7,843.80	-7,622.39	-6,900.05	-7,302.16	-7,241.00
A. Forest land	-8,804.42	-7,427.45	-8,397.99	-8,648.41	-7,967.84	-8,232.92	-8,286.49	-8,098.02	-7,282.42	-7,615.24	-7,821.45
B. Cropland	244.50	319.67	339.23	322.76	310.84	309.38	281.48	225.90	181.38	176.44	207.59
C. Grassland	-121.52	-131.83	-180.37	-173.94	-167.51	-161.07	-109.11	-67.22	-123.13	-123.13	-70.78
D. Wetlands	46.99	47.00	38.26	36.52	34.78	33.04	31.30	29.56	27.37	25.54	23.71
E. Settlements	192.72	197.11	355.96	411.28	463.41	519.49	566.76	615.18	526.43	530.18	584.94
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products	-185.70	-170.05	-106.47	-161.32	-90.96	-104.64	-299.45	-285.91	-285.59	-295.95	-165.01
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	4.38	6.15	6.68	3.78	0.80	0.35	0.16	0.74	0.65	0.67	0.16
A. Solid waste disposal	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
B. Biological treatment of solid waste											
C. Incineration and open burning of waste	4.38	6.15	6.68	3.78	0.80	0.35	0.16	0.74	0.65	0.67	0.16
D. Waste water treatment and discharge											
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Memo items:</b>											
<b>International bunkers</b>	311.54	258.78	291.47	262.60	251.70	284.43	337.55	325.65	353.05	384.96	292.16
Aviation	245.16	201.16	201.16	188.59	182.30	210.59	257.74	264.02	276.60	317.46	270.31
Navigation	66.37	57.62	90.31	74.01	69.39	73.83	79.82	61.63	76.45	67.50	21.85
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	C	C	C
<b>CO<sub>2</sub> emissions from biomass</b>	5,257.71	4,694.77	5,187.98	4,975.57	5,755.73	5,660.22	5,908.79	5,497.41	5,323.07	5,298.85	5,577.15
<b>CO<sub>2</sub> captured</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Long-term storage of C in waste disposal sites</b>	2,422.54	2,513.55	2,608.32	2,706.46	2,807.68	2,911.70	3,018.32	3,128.01	3,243.84	3,363.32	3,485.54
<b>Indirect N<sub>2</sub>O</b>											
<b>Indirect CO<sub>2</sub> (3)</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
<b>Total CO<sub>2</sub> equivalent emissions without land use, land-use change and forestry</b>	20,127.14	19,699.20	20,817.11	21,925.19	23,277.56	22,924.76	23,383.84	23,602.90	24,918.96	23,659.86	21,848.88
<b>Total CO<sub>2</sub> equivalent emissions with land use, land-use change and forestry</b>	11,499.71	12,533.66	12,865.74	13,712.08	15,860.28	15,288.04	15,540.05	15,980.51	18,018.91	16,357.70	14,607.88
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, without land use, land-use change and forestry</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, with land use, land-use change and forestry</b>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

CTF Table 1(a) Emission trend (CO<sub>2</sub>), cont.

Table 1(a)

HRV\_BR4\_v0.1

Emission trends (CO<sub>2</sub>)

(Sheet 3 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
									%
<b>1. Energy</b>	18,830.68	18,616.66	17,236.44	16,499.11	15,629.81	15,800.49	16,168.03	16,560.14	-19.83
A. Fuel combustion (sectoral approach)	18,264.34	18,035.28	16,744.87	16,029.43	15,174.35	15,544.80	15,945.51	16,264.30	-18.91
1. Energy industries	5,877.34	6,247.86	5,849.20	5,238.07	4,743.91	4,718.82	4,846.79	4,464.77	-36.66
2. Manufacturing industries and construction	3,015.80	2,779.55	2,409.07	2,380.65	2,324.33	2,222.70	2,207.24	2,408.17	-56.23
3. Transport	5,865.04	5,726.02	5,544.99	5,631.06	5,575.58	5,883.52	6,101.45	6,569.86	73.49
4. Other sectors	3,506.16	3,281.84	2,941.62	2,779.65	2,530.53	2,719.76	2,790.02	2,821.50	-24.13
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	0.00
B. Fugitive emissions from fuels	566.34	581.38	491.56	469.67	455.46	255.69	222.52	295.84	-50.74
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	0.00
2. Oil and natural gas and other emissions from energy production	566.34	581.38	491.56	469.67	455.46	255.69	222.52	295.84	-50.74
C. CO <sub>2</sub> transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>2. Industrial processes</b>	2,145.72	1,977.15	1,778.11	1,880.89	2,008.81	1,970.84	1,838.29	2,075.51	-21.08
A. Mineral industry	1,426.68	1,283.92	1,197.12	1,285.66	1,371.16	1,320.13	1,215.21	1,438.62	9.79
B. Chemical industry	615.36	593.19	502.01	509.33	559.83	572.27	547.86	566.79	-24.54
C. Metal industry	14.68	16.64	1.43	13.93	10.11	9.30	1.05	1.87	-99.45
D. Non-energy products from fuels and solvent use	89.00	83.40	77.55	71.97	67.71	69.14	74.16	68.22	-70.59
E. Electronic industry									
F. Product uses as ODS substitutes									
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	0.00
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>3. Agriculture</b>	88.04	105.18	101.23	74.61	69.47	69.34	76.17	81.13	62.19
A. Enteric fermentation									
B. Manure management									
C. Rice cultivation									
D. Agricultural soils									
E. Prescribed burning of savannas									
F. Field burning of agricultural residues									
G. Liming	21.46	21.32	14.38	14.23	19.99	12.09	11.20	10.92	100.00
H. Urea application	66.58	83.86	86.85	60.39	49.47	57.25	64.96	70.21	40.37
I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	0.00
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	
<b>4. Land Use, Land-Use Change and Forestry</b>	-7,199.71	-6,132.52	-5,792.78	-6,485.91	-6,529.74	-5,539.01	-5,639.72	-4,965.46	-25.76
A. Forest land	-7,644.50	-6,550.14	-6,172.66	-6,705.63	-6,413.14	-5,407.07	-5,515.38	-4,599.37	-31.53
B. Cropland	196.53	172.68	230.47	190.07	49.01	233.54	311.41	259.08	17.74
C. Grassland	-79.96	-59.41	-96.43	-61.65	-54.17	-118.11	-215.63	-160.46	57.55
D. Wetlands	21.87	20.03	18.18	16.33	14.49	12.64	10.79	8.95	-80.88
E. Settlements	543.77	543.95	537.84	535.98	532.13	546.08	532.50	534.60	222.53
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Harvested wood products	-237.43	-259.63	-310.18	-461.02	-658.07	-806.10	-763.42	-1,008.25	234.36
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>5. Waste</b>	0.05	0.05	0.08	0.04	0.04	0.05	0.05	NO, NA	
A. Solid waste disposal	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO, NA	NO, NA	0.00
B. Biological treatment of solid waste									
C. Incineration and open burning of waste	0.05	0.05	0.08	0.04	0.04	0.05	0.05	NO	
D. Waste water treatment and discharge									
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Memo items:</b>									
<b>International bunkers</b>	315.09	387.14	330.03	366.52	368.10	359.45	388.96	469.17	-27.13
Aviation	295.46	311.17	330.03	366.52	368.10	354.08	375.75	449.06	-9.58
Navigation	19.64	75.97	NO	NO	NO	5.37	13.21	20.11	-86.34
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	0.00
<b>CO<sub>2</sub> emissions from biomass</b>	5,940.99	5,834.61	6,017.15	5,962.40	5,249.83	6,010.65	5,893.14	5,906.62	15.22
<b>CO<sub>2</sub> captured</b>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Long-term storage of C in waste disposal sites</b>	3,583.56	3,696.79	3,832.35	3,971.56	4,097.53	4,246.97	4,373.62	4,486.55	161.27
<b>Indirect N<sub>2</sub>O</b>									
<b>Indirect CO<sub>2</sub> (3)</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO, NA	NO, NA	0.00
<b>Total CO<sub>2</sub> equivalent emissions without land use, land-use change and forestry</b>	21,064.49	20,699.04	19,115.87	18,454.66	17,708.13	17,840.71	18,082.53	18,716.77	-19.80
<b>Total CO<sub>2</sub> equivalent emissions with land use, land-use change and forestry</b>	13,864.78	14,566.52	13,323.08	11,968.74	11,178.39	12,301.70	12,442.81	13,751.31	-17.40
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, without land use, land-use change and forestry</b>	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>Total CO<sub>2</sub> equivalent emissions, including indirect CO<sub>2</sub>, with land use, land-use change and forestry</b>	NA	NA	NA	NA	NA	NA	NA	NA	0.00

CTF Table 1(b) Emission trend (CH<sub>4</sub>)

Table 1(b)

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Emission trends (CH<sub>4</sub>)

(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
<b>1. Energy</b>	33.71	33.71	31.70	27.90	29.11	26.49	27.16	28.41	27.08	26.58
A. Fuel combustion (sectoral approach)	16.56	16.56	17.69	15.08	15.74	14.40	15.19	16.90	15.81	15.97
1. Energy industries	0.22	0.22	0.16	0.18	0.20	0.13	0.16	0.16	0.18	0.21
2. Manufacturing industries and construction	0.39	0.39	0.28	0.22	0.21	0.19	0.19	0.19	0.21	0.21
3. Transport	1.64	1.64	1.24	1.11	1.09	1.18	1.24	1.33	1.41	1.45
4. Other sectors	14.31	14.31	16.01	13.57	14.25	12.89	13.60	15.22	14.02	14.11
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE
B. Fugitive emissions from fuels	17.16	17.16	14.01	12.82	13.37	12.09	11.97	11.51	11.26	10.61
1. Solid fuels	2.39	2.39	2.13	1.65	1.58	1.42	1.13	0.91	0.67	0.70
2. Oil and natural gas and other emissions from energy production	14.77	14.77	11.88	11.17	11.79	10.67	10.85	10.60	10.60	9.91
C. CO <sub>2</sub> transport and storage										
<b>2. Industrial processes</b>	0.37	0.37	0.35	0.30	0.25	0.26	0.23	0.21	0.22	0.20
A. Mineral industry										
B. Chemical industry	0.22	0.22	0.20	0.20	0.21	0.20	0.20	0.19	0.19	0.18
C. Metal industry	0.16	0.16	0.15	0.10	0.04	0.07	0.03	0.01	0.03	0.02
D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Agriculture</b>	103.51	103.51	99.25	84.97	85.69	78.82	75.25	72.91	70.81	68.95
A. Enteric fermentation	86.86	86.86	82.12	70.40	70.17	63.04	60.05	57.44	55.19	53.18
B. Manure management	16.64	16.64	17.12	14.57	15.52	15.78	15.19	15.48	15.62	15.77
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming										
H. Urea application										
I. Other carbon-containing fertilizers										
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>4. Land use, land-use change and forestry</b>	0.05	0.05	0.13	0.61	1.38	0.46	0.30	0.66	0.71	1.80
A. Forest land	0.04	0.04	0.12	0.55	1.31	0.43	0.28	0.61	0.65	1.59
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	0.00	0.00	0.01	0.06	0.06	0.03	0.02	0.06	0.05	0.21
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products										
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	39.36	39.36	40.30	41.18	42.01	43.07	43.86	44.67	46.02	47.03
A. Solid waste disposal	21.56	21.56	22.62	23.63	24.59	25.56	26.60	27.79	29.06	30.45
B. Biological treatment of solid waste	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE
C. Incineration and open burning of waste	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
D. Waste water treatment and discharge	17.80	17.80	17.67	17.55	17.43	17.51	17.25	16.87	16.96	16.58
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total CH<sub>4</sub> emissions without CH<sub>4</sub> from LULUCF</b>	176.95	176.95	171.59	154.35	157.07	148.63	146.50	146.20	144.12	142.75
<b>Total CH<sub>4</sub> emissions with CH<sub>4</sub> from LULUCF</b>	177.00	177.00	171.72	154.96	158.44	149.09	146.80	146.86	144.83	144.55
<b>Memo items:</b>										
<b>International bunkers</b>	0.02	0.02	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	0.01	0.01	NO	NO	NO	0.01	0.01	0.01	0.01	0.01
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	C	C
<b>CO<sub>2</sub> emissions from biomass</b>										
<b>CO<sub>2</sub> captured</b>										
<b>Long-term storage of C in waste disposal sites</b>										
<b>Indirect N<sub>2</sub>O</b>										
<b>Indirect CO<sub>2</sub> (3)</b>										

CTF Table 1(b) Emission trend (CH<sub>4</sub>), cont.

Table 1(b)

HRV\_BR4\_v0.1

Emission trends (CH<sub>4</sub>)  
(Sheet 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>1. Energy</b>	25.63	23.65	25.29	24.94	26.97	26.44	27.25	26.69	26.60	26.06	26.24
A. Fuel combustion (sectoral approach)	15.76	14.12	15.13	14.56	16.53	16.08	16.86	15.55	15.02	14.95	15.46
1. Energy industries	0.22	0.16	0.18	0.20	0.23	0.19	0.18	0.19	0.22	0.19	0.19
2. Manufacturing industries and construction	0.17	0.18	0.18	0.17	0.20	0.24	0.22	0.23	0.23	0.22	0.21
3. Transport	1.48	1.43	1.22	1.19	1.14	1.07	1.01	0.97	0.93	0.86	0.82
4. Other sectors	13.89	12.36	13.55	13.00	14.96	14.58	15.45	14.16	13.63	13.68	14.24
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE
B. Fugitive emissions from fuels	9.87	9.53	10.17	10.38	10.43	10.36	10.39	11.14	11.58	11.11	10.78
1. Solid fuels	0.21	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	9.66	9.53	10.17	10.38	10.43	10.36	10.39	11.14	11.58	11.11	10.78
C. CO <sub>2</sub> transport and storage											
<b>2. Industrial processes</b>	0.20	0.14	0.14	0.13	0.12	0.15	0.15	0.15	0.14	0.13	0.12
A. Mineral industry											
B. Chemical industry	0.18	0.12	0.14	0.13	0.12	0.15	0.15	0.15	0.14	0.13	0.12
C. Metal industry	0.02	0.02	0.00	0.00	0.00	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Agriculture</b>	69.06	66.63	67.68	66.39	67.89	73.00	70.56	71.93	68.47	65.50	67.02
A. Enteric fermentation	51.90	50.00	50.52	48.95	49.63	53.25	52.37	51.89	49.33	47.85	48.01
B. Manure management	17.16	16.63	17.16	17.44	18.26	19.75	18.19	20.04	19.13	17.65	19.01
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming											
H. Urea application											
I. Other carbon-containing fertilizers											
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>4. Land use, land-use change and forestry</b>	0.24	3.88	0.76	0.26	1.58	0.12	0.11	0.24	1.27	0.38	0.20
A. Forest land	0.17	3.48	0.64	0.22	1.44	0.08	0.09	0.22	1.18	0.35	0.19
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	0.07	0.39	0.12	0.03	0.14	0.04	0.02	0.02	0.09	0.04	0.01
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products											
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	48.65	50.53	51.32	53.16	55.12	57.53	57.50	61.29	64.85	68.57	70.60
A. Solid waste disposal	31.87	33.49	35.17	37.12	39.30	41.46	41.56	45.18	48.47	52.46	56.52
B. Biological treatment of solid waste	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	0.06	0.06	0.05
C. Incineration and open burning of waste	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
D. Waste water treatment and discharge	16.78	17.04	16.14	16.04	15.82	16.07	15.95	16.12	16.33	16.05	14.03
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total CH<sub>4</sub> emissions without CH<sub>4</sub> from LULUCF</b>	143.54	140.95	144.44	144.61	150.11	157.12	155.46	160.06	160.05	160.26	163.98
<b>Total CH<sub>4</sub> emissions with CH<sub>4</sub> from LULUCF</b>	143.77	144.82	145.20	144.87	151.69	157.24	155.57	160.30	161.33	160.64	164.18
<b>Memo items:</b>											
<b>International bunkers</b>	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	C	C	C
<b>CO<sub>2</sub> emissions from biomass</b>											
<b>CO<sub>2</sub> captured</b>											
<b>Long-term storage of C in waste disposal sites</b>											
<b>Indirect N<sub>2</sub>O</b>											
<b>Indirect CO<sub>2</sub> (3)</b>											



CTF Table 1(b) Emission trend (CH<sub>4</sub>), cont.

Table 1(b)

HRV\_BR4\_v0.1

Emission trends (CH<sub>4</sub>)  
(Sheet 3 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	%								
<b>1. Energy</b>	27.25	25.94	24.43	23.86	21.46	23.80	23.42	22.98	-31.83
A. Fuel combustion (sectoral approach)	16.43	15.97	15.81	15.67	13.81	15.72	15.30	14.97	-9.59
1. Energy industries	0.17	0.20	0.20	0.17	0.13	0.17	0.22	0.28	27.53
2. Manufacturing industries and construction	0.21	0.18	0.19	0.18	0.15	0.13	0.11	0.14	-63.94
3. Transport	0.73	0.67	0.56	0.56	0.51	0.50	0.47	0.46	-72.04
4. Other sectors	15.32	14.92	14.86	14.77	13.01	14.92	14.50	14.09	-1.50
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	0.00
B. Fugitive emissions from fuels	10.82	9.96	8.62	8.19	7.65	8.09	8.12	8.01	-53.30
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	
2. Oil and natural gas and other emissions from energy production	10.82	9.96	8.62	8.19	7.65	8.09	8.12	8.01	-45.76
C. CO <sub>2</sub> transport and storage									
<b>2. Industrial processes</b>	0.11	0.07	NO, NE, IE, NA	NO, NE, IE, NA	NO, NE, IE, NA	NO, NE, IE, NA	NO, NE, IE, NA	NO, NE, IE, NA	
A. Mineral industry									
B. Chemical industry	0.11	0.07	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	
C. Metal industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	
D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	0.00
E. Electronic industry									
F. Product uses as ODS substitutes									
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	0.00
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>3. Agriculture</b>	67.22	66.87	65.62	63.43	62.43	65.48	64.85	61.22	-40.85
A. Enteric fermentation	48.29	48.15	47.61	46.28	45.19	47.66	47.14	44.28	-49.03
B. Manure management	18.93	18.72	18.01	17.14	17.24	17.82	17.71	16.95	1.82
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Agricultural soils	NA	NA	NA	NA	NA	NA	NA	NA	0.00
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	0.00
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Liming									
H. Urea application									
I. Other carbon-containing fertilizers									
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	
<b>4. Land use, land-use change and forestry</b>	0.07	0.75	1.56	0.08	0.01	0.56	0.36	2.77	5,526.84
A. Forest land	0.07	0.61	1.44	0.06	0.01	0.39	0.30	2.45	5,357.01
B. Cropland	NO	NO	NO	NO	0.00	0.10	0.00	0.02	100.00
C. Grassland	0.00	0.14	0.11	0.02	0.00	0.06	0.06	0.30	6,839.01
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	0.00
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	0.00
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Harvested wood products									
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>5. Waste</b>	73.08	74.28	74.15	69.44	73.24	74.83	80.67	80.13	103.57
A. Solid waste disposal	58.08	59.72	61.38	61.79	64.33	66.80	68.65	71.01	229.35
B. Biological treatment of solid waste	0.05	0.06	0.10	0.16	0.16	0.30	0.15	0.15	100.00
C. Incineration and open burning of waste	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO, NA	NO, NA	0.00
D. Waste water treatment and discharge	14.95	14.50	12.67	7.49	8.75	7.72	11.87	8.97	-49.62
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Total CH<sub>4</sub> emissions without CH<sub>4</sub> from LULUCF</b>	167.66	167.16	164.21	156.73	157.12	164.11	168.94	164.33	-7.13
<b>Total CH<sub>4</sub> emissions with CH<sub>4</sub> from LULUCF</b>	167.73	167.90	165.76	156.80	157.14	164.66	169.30	167.10	-5.59
<b>Memo items:</b>									
<b>International bunkers</b>	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-70.85
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-10.82
Navigation	0.00	0.01	NO	NO	NO	0.00	0.00	0.00	-86.23
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	0.00
<b>CO<sub>2</sub> emissions from biomass</b>									
<b>CO<sub>2</sub> captured</b>									
<b>Long-term storage of C in waste disposal sites</b>									
<b>Indirect N<sub>2</sub>O</b>									
<b>Indirect CO<sub>2</sub> (3)</b>									

CTF Table 1(c) Emission trend (N<sub>2</sub>O)

Table 1(c)

HRV\_BR4\_v0.1

Emission trends (N<sub>2</sub>O)  
(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
<b>1. Energy</b>	0.77	0.77	0.67	0.60	0.65	0.63	0.60	0.77	0.76	0.70
A. Fuel combustion (sectoral approach)	0.77	0.77	0.67	0.60	0.65	0.63	0.60	0.77	0.76	0.70
1. Energy industries	0.06	0.06	0.04	0.05	0.06	0.04	0.04	0.04	0.05	0.06
2. Manufacturing industries and construction	0.06	0.06	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
3. Transport	0.18	0.18	0.15	0.13	0.16	0.16	0.15	0.24	0.28	0.20
4. Other sectors	0.47	0.47	0.44	0.39	0.40	0.40	0.38	0.46	0.40	0.42
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid fuels	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
2. Oil and natural gas and other emissions from energy production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. CO <sub>2</sub> transport and storage										
<b>2. Industrial processes</b>	2.64	2.64	2.34	3.02	2.30	2.48	2.39	2.23	2.34	1.79
A. Mineral industry										
B. Chemical industry	2.53	2.53	2.22	2.90	2.19	2.37	2.27	2.12	2.23	1.68
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Agriculture</b>	5.91	5.91	5.84	5.34	4.73	4.67	4.49	4.50	5.03	4.45
A. Enteric fermentation										
B. Manure management	1.21	1.21	1.17	0.95	0.96	0.90	0.84	0.81	0.78	0.76
C. Rice cultivation										
D. Agricultural soils	4.70	4.70	4.67	4.39	3.77	3.77	3.65	3.69	4.25	3.69
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming										
H. Urea application										
I. Other carbon containing fertilizers										
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>4. Land use, land-use change and forestry</b>	0.11	0.11	0.12	0.14	0.19	0.14	0.13	0.15	0.15	0.22
A. Forest land	0.00	0.00	0.01	0.03	0.07	0.02	0.02	0.03	0.04	0.09
B. Cropland	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
C. Grassland	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.02
D. Wetlands	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
E. Settlements	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products										
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	0.22	0.22	0.21	0.21	0.21	0.22	0.24	0.23	0.23	0.23
A. Solid waste disposal										
B. Biological treatment of solid waste	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste water treatment and discharge	0.22	0.22	0.21	0.21	0.21	0.22	0.24	0.23	0.23	0.23
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total direct N<sub>2</sub>O emissions without N<sub>2</sub>O from LULUCF</b>	9.55	9.55	9.05	9.17	7.90	8.01	7.72	7.74	8.37	7.17
<b>Total direct N<sub>2</sub>O emissions with N<sub>2</sub>O from LULUCF</b>	9.66	9.66	9.17	9.31	8.08	8.14	7.85	7.89	8.52	7.39
<b>Memo items:</b>										
<b>International bunkers</b>	0.02	0.02	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Aviation	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Navigation	0.00	0.00	NO	NO	NO	0.00	0.00	0.00	0.00	0.00
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	C	C
<b>CO<sub>2</sub> emissions from biomass</b>										
<b>CO<sub>2</sub> captured</b>										
<b>Long-term storage of C in waste disposal sites</b>										
<b>Indirect N<sub>2</sub>O</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
<b>Indirect CO<sub>2</sub> (3)</b>										

CTF Table 1(c) Emission trend (N<sub>2</sub>O), cont.

Table 1(c)

HRV\_BR4\_v0.1

Emission trends (N<sub>2</sub>O)  
(Sheet 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>1. Energy</b>	0.89	0.92	0.91	0.76	0.81	0.95	0.80	0.80	0.83	0.82	0.79
A. Fuel combustion (sectoral approach)	0.89	0.92	0.91	0.76	0.81	0.95	0.80	0.80	0.83	0.82	0.79
1. Energy industries	0.06	0.06	0.07	0.08	0.09	0.08	0.08	0.08	0.09	0.08	0.07
2. Manufacturing industries and construction	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.03	0.03
3. Transport	0.35	0.37	0.35	0.22	0.22	0.39	0.23	0.25	0.26	0.25	0.24
4. Other sectors	0.45	0.46	0.46	0.43	0.47	0.44	0.46	0.45	0.44	0.45	0.45
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid fuels	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
2. Oil and natural gas and other emissions from energy production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. CO <sub>2</sub> transport and storage											
<b>2. Industrial processes</b>	2.09	2.44	2.07	2.01	1.91	2.30	2.25	2.22	2.44	2.49	2.10
A. Mineral industry											
B. Chemical industry	1.98	2.33	1.95	1.90	1.80	2.19	2.14	2.11	2.33	2.38	1.99
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>3. Agriculture</b>	4.71	4.72	5.01	4.87	4.60	4.95	4.95	5.03	4.95	5.91	4.19
A. Enteric fermentation											
B. Manure management	0.78	0.73	0.73	0.71	0.72	0.76	0.70	0.72	0.67	0.62	0.63
C. Rice cultivation											
D. Agricultural soils	3.93	3.99	4.28	4.16	3.88	4.19	4.25	4.31	4.28	5.29	3.56
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming											
H. Urea application											
I. Other carbon containing fertilizers											
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>4. Land use, land-use change and forestry</b>	0.13	0.34	0.19	0.18	0.28	0.22	0.25	0.28	0.34	0.29	0.28
A. Forest land	0.01	0.19	0.04	0.01	0.08	0.00	0.00	0.01	0.07	0.02	0.01
B. Cropland	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
C. Grassland	0.01	0.04	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
D. Wetlands	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
E. Settlements	0.08	0.08	0.11	0.13	0.16	0.18	0.21	0.23	0.24	0.24	0.24
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products											
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>5. Waste</b>	0.24	0.23	0.25	0.26	0.26	0.26	0.27	0.28	0.29	0.29	0.29
A. Solid waste disposal											
B. Biological treatment of solid waste	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	NO, NE, IE	0.00	0.00	0.00
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA, NO, IE
D. Waste water treatment and discharge	0.24	0.23	0.25	0.26	0.26	0.26	0.27	0.28	0.28	0.29	0.29
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Total direct N<sub>2</sub>O emissions without N<sub>2</sub>O from LULUCF</b>	7.93	8.32	8.24	7.91	7.59	8.46	8.27	8.34	8.50	9.51	7.38
<b>Total direct N<sub>2</sub>O emissions with N<sub>2</sub>O from LULUCF</b>	8.06	8.66	8.42	8.09	7.87	8.68	8.51	8.62	8.84	9.80	7.66
<b>Memo items:</b>											
<b>International bunkers</b>	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Aviation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Navigation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	C	C	C
<b>CO<sub>2</sub> emissions from biomass</b>											
<b>CO<sub>2</sub> captured</b>											
<b>Long-term storage of C in waste disposal sites</b>											
<b>Indirect N<sub>2</sub>O</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
<b>Indirect CO<sub>2</sub> (3)</b>											

CTF Table 1(c) Emission trend (N<sub>2</sub>O), cont.

Table 1(c)

HRV\_BR4\_v0.1

Emission trends (N<sub>2</sub>O)  
(Sheet 3 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	%								
<b>1. Energy</b>	0.79	0.74	0.72	0.70	0.66	0.70	0.71	0.72	-6.81
A. Fuel combustion (sectoral approach)	0.79	0.74	0.72	0.70	0.66	0.70	0.71	0.72	-6.62
1. Energy industries	0.07	0.08	0.07	0.07	0.06	0.07	0.08	0.07	23.23
2. Manufacturing industries and construction	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	-64.56
3. Transport	0.23	0.19	0.19	0.18	0.18	0.19	0.20	0.21	20.20
4. Other sectors	0.45	0.45	0.43	0.42	0.40	0.43	0.42	0.41	-13.15
5. Other	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	NO, IE	0.00
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-70.21
1. Solid fuels	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
2. Oil and natural gas and other emissions from energy production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-70.21
C. CO <sub>2</sub> transport and storage									
<b>2. Industrial processes</b>	2.67	2.64	2.33	0.95	0.96	1.15	0.55	0.54	-79.57
A. Mineral industry									
B. Chemical industry	2.57	2.53	2.19	0.81	0.89	1.04	0.37	0.33	-86.93
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	0.00
E. Electronic industry									
F. Product uses as ODS substitutes									
G. Other product manufacture and use	0.10	0.11	0.14	0.14	0.06	0.10	0.19	0.21	86.76
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
<b>3. Agriculture</b>	4.45	4.74	4.34	3.78	3.60	3.94	3.76	4.14	-30.03
A. Enteric fermentation									
B. Manure management	0.62	0.59	0.57	0.55	0.54	0.56	0.55	0.52	-57.54
C. Rice cultivation									
D. Agricultural soils	3.83	4.15	3.76	3.23	3.06	3.38	3.21	3.62	-22.92
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	0.00
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Liming									
H. Urea application									
I. Other carbon containing fertilizers									
J. Other	NO	NO	NO	NO	NO	NO	NO		
<b>4. Land use, land-use change and forestry</b>	0.27	0.32	0.36	0.28	0.27	0.30	0.29	0.44	295.70
A. Forest land	0.00	0.03	0.08	0.00	0.00	0.02	0.02	0.14	5,357.01
B. Cropland	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	51.37
C. Grassland	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.03	6,839.01
D. Wetlands	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	-78.29
E. Settlements	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	239.41
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Harvested wood products									
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>5. Waste</b>	0.28	0.28	0.29	0.30	0.30	0.31	0.31	0.31	36.36
A. Solid waste disposal									
B. Biological treatment of solid waste	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.01	100.00
C. Incineration and open burning of waste	NA, NO, IE	NA, NO, IE	NA, NO, IE	NA, NO, IE	NA, NO, IE	NA, NO, IE	NO, IE, NA	NO, NA	
D. Waste water treatment and discharge	0.28	0.28	0.29	0.29	0.29	0.29	0.30	0.30	32.36
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>6. Other (as specified in the summary table in CRF)</b>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Total direct N<sub>2</sub>O emissions without N<sub>2</sub>O from LULUCF</b>	8.19	8.41	7.68	5.73	5.52	6.10	5.33	5.70	-40.30
<b>Total direct N<sub>2</sub>O emissions with N<sub>2</sub>O from LULUCF</b>	8.46	8.72	8.04	6.00	5.79	6.40	5.62	6.14	-36.47
<b>Memo items:</b>									
<b>International bunkers</b>	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-27.26
Aviation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-10.82
Navigation	0.00	0.00	NO	NO	NO	0.00	0.00	0.00	-86.23
<b>Multilateral operations</b>	C	C	C	C	C	C	C	C	0.00
<b>CO<sub>2</sub> emissions from biomass</b>									
<b>CO<sub>2</sub> captured</b>									
<b>Long-term storage of C in waste disposal sites</b>									
<b>Indirect N<sub>2</sub>O</b>	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO, NA	NO, NA	0.00
<b>Indirect CO<sub>2</sub> (3)</b>									

CTF Table 1(d) Emission trend (HFC-i, PFC-i i SF<sub>6</sub>)

Table 1(d)

HRV\_BR4\_v0.1

Emission trends (HFCs, PFCs and SF<sub>6</sub>)  
(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year <sup>a</sup>	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
<b>Emissions of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	1,240.24	1,240.24	850.75	NO	NO	NO	29.32	49.77	71.93	101.88
<b>Emissions of HFCs - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	29.32	49.77	71.93	101.88
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-32	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	NO	NO	NO	NO	NO	NO	0.00	0.00	0.01	0.01
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	NO	NO	NO	NO	NO	NO	0.01	0.01	0.02	0.03
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.01
HFC-152	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-152a	NO	NO	NO	NO	NO	NO	NO, NE	NO, NE	NO, NE	NO, NE
HFC-161	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-227ea	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00
HFC-236cb	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-365mfc	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of HFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Emissions of PFCs - (kt CO<sub>2</sub> equivalent)</b>	1,240.24	1,240.24	850.75	NO	NO	NO	NO	NO	NO	NO
CF <sub>4</sub>	0.12	0.12	0.08	NO	NO	NO	NO	NO	NO	NO
C <sub>2</sub> F <sub>6</sub>	0.03	0.03	0.02	NO	NO	NO	NO	NO	NO	NO
C <sub>3</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>4</sub> F <sub>10</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
i-C <sub>4</sub> F <sub>10</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>5</sub> F <sub>12</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>6</sub> F <sub>14</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C10F18	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
i-C3F6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of PFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Unspecified mix of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Emissions of SF<sub>6</sub> - (kt CO<sub>2</sub> equivalent)</b>	10.45	10.45	10.33	10.42	10.53	10.64	11.12	11.57	11.43	11.99
SF <sub>6</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Emissions of NF<sub>3</sub> - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

CTF Table 1(d) Emission trend (HFC-i, PFC-i i SF<sub>6</sub>), cont.

Table 1(d)

HRV\_BR4\_v0.1

Emission trends (HFCs, PFCs and SF<sub>6</sub>)  
(Sheet 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>Emissions of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	122.08	147.90	161.46	185.34	212.23	240.33	265.80	292.57	326.74	338.04	341.61
<b>Emissions of HFCs - (kt CO<sub>2</sub> equivalent)</b>	122.08	147.90	161.46	185.34	212.23	240.33	265.80	292.57	326.74	338.04	341.35
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-32	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0.04	0.06	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.14	0.14
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
HFC-152	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-152a	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	0.00	0.00	NO, NE	0.00
HFC-161	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-365mfc	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of HFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Emissions of PFCs - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.26
CF <sub>4</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>2</sub> F <sub>6</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>3</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C <sub>4</sub> F <sub>10</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
o-C <sub>4</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>6</sub> F <sub>12</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C <sub>6</sub> F <sub>14</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C10F18	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
o-C3F6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of PFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Unspecified mix of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Emissions of SF<sub>6</sub> - (kt CO<sub>2</sub> equivalent)</b>	11.99	11.62	11.69	12.01	12.28	12.57	13.03	13.01	13.05	11.98	8.03
SF <sub>6</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Emissions of NF3 - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NF3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

CTF Table 1(d) Emission trend (HFC-i, PFC-i i SF<sub>6</sub>), cont.

Table 1(d)

HRV\_BR4\_v0.1

Emission trends (HFCs, PFCs and SF<sub>6</sub>)  
(Sheet 3 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	%								
<b>Emissions of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	378.91	396.21	397.31	469.19	474.76	482.50	483.53	488.71	-60.60
<b>Emissions of HFCs - (kt CO<sub>2</sub> equivalent)</b>	378.87	396.20	397.28	469.19	474.76	482.50	483.53	488.71	100.00
HFC-23	0.00	0.00	NO	NO	NO	NO	NO	NO	0.00
HFC-32	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	100.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-125	0.02	0.03	0.03	0.05	0.05	0.05	0.05	0.05	100.00
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-134a	0.15	0.15	0.15	0.11	0.11	0.11	0.11	0.11	100.00
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-143a	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	100.00
HFC-152	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-152a	0.04	NO, NE	NO, NE	0.00	0.00	0.00	0.00	0.00	100.00
HFC-161	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-236cb	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-236ea	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-236fa	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-245fa	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-365mfc	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Unspecified mix of HFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Emissions of PFCs - (kt CO<sub>2</sub> equivalent)</b>	0.03	0.02	0.03	NO	NO	NO	NO	NO	
CF <sub>4</sub>	0.00	NO	NO	NO	NO	NO	NO	NO	
C <sub>2</sub> F <sub>6</sub>	NO	NO	NO	NO	NO	NO	NO	NO	
C <sub>3</sub> F <sub>8</sub>	0.00	0.00	0.00	NO	NO	NO	NO	NO	0.00
C <sub>4</sub> F <sub>10</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
c-C <sub>4</sub> F <sub>8</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C <sub>3</sub> F <sub>12</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C <sub>6</sub> F <sub>14</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C10F18	NO	NO	NO	NO	NO	NO	NO	NO	0.00
c-C3F6	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Unspecified mix of PFCs(4) - (kt CO <sub>2</sub> equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Unspecified mix of HFCs and PFCs - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
<b>Emissions of SF<sub>6</sub> - (kt CO<sub>2</sub> equivalent)</b>	8.95	9.37	9.18	6.05	6.77	5.22	6.39	6.39	-38.84
SF <sub>6</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-38.84
<b>Emissions of NF<sub>3</sub> - (kt CO<sub>2</sub> equivalent)</b>	NO	NO	NO	NO	NO	NO	NO	NO	0.00
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	0.00

CTF Table 2(a) Description of quantified economy-wide emission reduction target: base year  
Table 2(a) HRV\_BR4\_v0.1

**Description of quantified economy-wide emission reduction target: base year<sup>a</sup>**

<i>Party</i>	<i>Croatia</i>	
Base year /base period	1990	
Emission reduction target	% of base year/base period	% of 1990 <sup>b</sup>
	20.00	20.00
Period for reaching target	BY-2020	

CTF Table 2(b) Description of quantified economy-wide emission reduction target: gases and sectors covered

Table 2(b) HRV\_BR4\_v0.1

**Description of quantified economy-wide emission reduction target:  
gases and sectors covered<sup>a</sup>**

<i>Gases covered</i>		<i>Base year for each gas (year):</i>
CO <sub>2</sub>		1990
CH <sub>4</sub>		1990
N <sub>2</sub> O		1990
HFCs		1990
PFCs		1990
SF <sub>6</sub>		1990
NF <sub>3</sub>		
Other Gases (specify)		
Sectors covered <sup>b</sup>	Energy	Yes
	Transport <sup>f</sup>	Yes
	Industrial processes <sup>g</sup>	Yes
	Agriculture	Yes
	LULUCF	No
	Waste	Yes
	Other Sectors (specify)	



CTF Table 2(c) Description of quantified economy-wide emission reduction target: global warming potential values (GWP)

Table 2(c)

HRV\_BR4\_v0.1

**Description of quantified economy-wide emission reduction target: global warming potential values (GWP)<sup>a</sup>**

<i>Gases</i>	<i>GWP values<sup>b</sup></i>
CO <sub>2</sub>	4th AR
CH <sub>4</sub>	4th AR
N <sub>2</sub> O	4th AR
HFCs	4th AR
PFCs	4th AR
SF <sub>6</sub>	4th AR
NF <sub>3</sub>	
Other Gases (specify)	

CTF Table 2(d) Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF

Table 2(d)

HRV\_BR4\_v0.1

**Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector<sup>a</sup>**

<b>Role of LULUCF</b>	LULUCF in base year level and target	Excluded
	Contribution of LULUCF is calculated using	

CTF Table 2(e)I Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention and other market-based mechanisms

Table 2(e)I

HRV\_BR4\_v0.1

**Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention<sup>a</sup>**

<i>Market-based mechanisms under the Convention</i>	<i>Possible scale of contributions (estimated kt CO<sub>2</sub> eq)</i>
CERs	
ERUs	
AAUs <sup>i</sup>	
Carry-over units <sup>j</sup>	
Other mechanism units under the Convention (specify) <sup>d</sup>	

## CTF Table 2(e)II Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention and other market-based mechanisms

Table 2(e)II

HRV\_BR4\_v0.1

**Description of quantified economy-wide emission reduction target: other market-based mechanisms<sup>a</sup>**

<i>Other market-based mechanisms</i>	<i>Possible scale of contributions</i>
<i>(Specify)</i>	<i>(estimated kt CO<sub>2</sub> eq)</i>

## CTF Table 2(f) Description of quantified economy-wide emission reduction target: any other information

Table 2(f)

HRV\_BR4\_v0.1

**Description of quantified economy-wide emission reduction target: any other information<sup>a b</sup>**

The 2020 EU Climate and Energy Package allows Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) to be used for compliance purposes, subject to a number of restrictions in terms of origin and type of project and up to an established limit. In addition, the legislation foresees the possible recognition of units from new market mechanisms. Under the EU ETS the limit does not exceed 50 % of the required reduction below 2005 levels. In the sectors not covered by the ETS, annual use shall not exceed to 3 % of each Member States' non-ETS greenhouse gas emissions in 2005. A limited number of Member States may use an additional 1 %, from projects in LDCs or SIDS subject to conditions.

The use of ERUs and CERs units under the ETS Directive and the Effort Sharing Decision is subject to the limits specified above which do not separate between CERs and ERUs, but include additional criteria for the use of CERs.

AAUs for the period 2013-2020 have not yet been determined.

The EU expects to achieve its 20 % target for the period 2013-2020 with the implementation of the ETS Directive and the ESD Decision in the non-ETS sectors which do not allow the use of AAUs from non-EU Parties.

CTF Table 3 Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
Committee for cross-sectoral coordination of policies and measures for mitigation and adaptation to climate change*	Cross-cutting	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub>	Indirect contribution to reducing greenhouse gas emissions	Regulatory	Implemented	The Commission, established in 2014, is responsible for monitoring and evaluating the implementation and planning of climate change mitigation and adaptation policies and measures in the Republic of Croatia. The Committee members include representatives of relevant government bodies and other relevant organizations, agencies and non-governmental organizations. The composition of the Commission, the affairs and manner of work of the Commission shall be determined by the Croatian Government of Croatia at the proposal of the ministry responsible for environmental protection.	2014	Ministry of Environment and Energy					
Encouraging the establishment of regional energy and climate agencies and capacity building*	Cross-cutting	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub>	Establishment of an energy and climate agency and transformation of existing regional energy agencies into regional energy and climate agencies	Other (Organizational), Economic	Implemented	Regional energy agencies are not currently active in the whole of the Republic of Croatia, and capacity building of existing regional energy agencies in the field of climate change is needed and their transformation into energy and climate agencies. The aim of this measure is to encourage the establishment of regional energy agencies for the areas of the Republic of Croatia in which they do not operate and to transform the existing energy agencies into energy and climate agencies.	2019	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
Promotion of the use of innovative information and communication technologies (ICT) to reduce greenhouse gas emissions*	Cross-cutting	CO <sub>2</sub>	Monitoring and verification of energy savings	Information	Implemented	Innovative information and communication technologies are playing an increasingly important role in reducing greenhouse gas emissions and increasing energy efficiency. Intensifying their use in public administration, services and production processes will increase productivity and efficiency while reducing energy consumption and the resulting greenhouse gas emissions. The measure is expected to increase the use of innovative ICTs and monitor real energy savings and reductions in greenhouse gas emissions.	2014	Ministry of Environment and Energy, Ministry of Construction and Physical Planning, Ministry of Economy, Entrepreneurship and Crafts					
Emissions Trading System *	Cross-cutting	CO <sub>2</sub> , N <sub>2</sub> O, PFCs	Reduction of greenhouse gas emissions by operators within the EU ETS	Regulatory	Implemented	Through an even distribution of emission allowances, reduction commitments are distributed to system participants from all Member States with the aim of contributing to a reduction of emissions at EU level of at least 43% by 2030 compared to 2005 levels.	2013	Ministry of Environment and Energy					
CO <sub>2</sub> emission tax for non-EU ETS stationary sources*	Cross-cutting	CO <sub>2</sub>	Reducing the use of fossil fuels and consequently reducing the emissions of CO <sub>2</sub> and other GHG	Regulatory, Fiscal	Implemented	Regulation on unit charges, corrective coefficients and detailed criteria and benchmarks for determination of the fee for emissions into the environment of carbon dioxide (Official Gazette 73/07, 48/09, 02/18) provides for the payment of fees on CO <sub>2</sub> emissions for all stationary sources that emit more than 450 tonnes of CO <sub>2</sub> per year. Compensators who pay for energy efficiency investments, RES and other	2013	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						measures to reduce CO <sub>2</sub> and other greenhouse gas emissions are charged a lower fee. The Environmental and Energy Efficiency Fund is authorized to calculate and collect costs. From 2013 onwards, the obligation to pay the CO <sub>2</sub> emission allowance applies only to sources not covered by the ETS.							
Covenant of Mayors for Climate and Energy in the Republic of Croatia*	Cross-cutting	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O	Reducing energy consumption and greenhouse gas emissions	Other (Organizational)	Implemented	The signatories to the Agreement support a common vision for 2050: accelerating the decarbonisation of their territories, strengthening the capacity to adapt to the inevitable impact of climate change, and providing citizens with access to safe, sustainable and affordable energy. The agreement covers 82 cities and municipalities, or more than 2 million inhabitants in the Republic of Croatia.	2009	Cities and municipalities					
Charter for Cooperation for Decarbonisation of Buildings by 2050*	Cross-cutting	CO <sub>2</sub>	Efficiency improvements of buildings (Energy consumption)	Information, Education, Regulatory	Implemented	Charter for Cooperation for Decarbonisation of Buildings by 2050, launched by the Ministry of Construction and Physical Planning, which supports the EU's vision for decarbonisation of buildings by 2050 - The Charter was launched to improve inter-ministerial communication and cooperation between public authorities and the real sector. The aim is to create, through workshops and open partner dialogue, a wide network of connected professionals who are ready for joint dialogue and contribution to the	2019	Ministry of Construction and Physical Planning					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						decarbonisation of the building stock by 2050. Open partner dialogues bring together representatives of state and local government, academia and the professional public, the construction and energy sectors and related industries at thematic workshops organized by the Ministries of Construction and Physical Planning. The contents of the charter relate to the achievement of energy and climate goals at national and EU level through the decarbonisation of the building stock, the renovation of buildings and the construction of near-zero energy buildings, aware of the importance of further reducing greenhouse gas emissions, increasing the share of renewable energy sources, improving energy security and introducing innovation and smart technologies that enable buildings to support the overall decarbonisation of the economy. The signing of the Charter encourages continued cooperation on the development of a Long-Term National Building Fund Restoration Strategy and the transition to a near zero energy building standard (nZEB). The signatories of the Charter support and promote the decarbonisation of buildings in their further activities, wherever possible.							

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Breaif description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
Establishment of a platform for the CO2 collection, use and storage	Cross-cutting	CO2	Reduction of GHG emissions	Research, Economic	Planned	Carbon capture and storage technology for large emission sources is not yet commercially available. According to Directive 2009/31 / EC on the geological storage of carbon dioxide, ie Article 36 of Directive 2010/75 / EU on industrial emissions, for power plants with a capacity of more than 300 MW which have received a building permit after the entry into force of Directive 2009/31 / EC geological storage of carbon dioxide, it is necessary to assess whether the following conditions are met: a) availability of suitable storage location, b) technical and economic feasibility of transport facilities, and c) technical and economic feasibility of upgrading CO2 capture and collection facilities. If these conditions are met, the competent authority must provide at the installation site adequate space for the equipment to capture and compress the extracted CO2. Legally, this is covered by the Law on Hydrocarbon Exploration and Exploitation (OG 52/18, 52/19), which enables the storage of CO2 on the territory of the Republic of Croatia. This method needs to be further developed and the potentials and opportunities for this technology at country level should be considered. Accordingly, it is planned to develop a study of the assessment of storage capacities, but also	2021	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						to develop a National Feasibility Study with an action plan for preparatory activities for CCS projects. This study will cover the capture stages of the emission sources, transport, injection and storage of CO <sub>2</sub> , and the interconnection of the CO <sub>2</sub> transport system with other EU countries. Activities include: - conducting research into the potential for geological storage of CO <sub>2</sub> in the Republic of Croatia, - drafting / supplementing a study on the assessment of storage capacities available in the territory of the Republic of Croatia, - implementation of projects of geological storage of CO <sub>2</sub> in the Republic of Croatia in accordance with the expressed potentials.							
Improving sustainability of urban areas	Cross-cutting	CO <sub>2</sub>	Reduction of heat demand and energy consumption in public and residential buildings and increase of RES usage and consequently reduction of CO <sub>2</sub> emissions	Research, Economic	Planned	The Ministry of Construction and Physical Planning is in the process of developing new national Green Infrastructure Development Programs in urban areas and the Circular Spatial Management and Building Development Program, which achieve the environmental, economic and social benefits of sustainable development. The Green Infrastructure Development Program in urban areas elaborates the goals and measures for the development of green infrastructure, which, among other things, have an impact on increasing the energy efficiency of buildings, reducing CO <sub>2</sub>	2021	Ministry of Construction and Physical Planning, Faculty of Architecture					



Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						emissions and reducing the temperature in thermal island areas in urban areas. The Circular Spatial and Building Management Development Program elaborates goals and measures for circular spatial and building management that encourage, among other things, measures of circularity when planning new buildings, reusing abandoned and / or neglected and extending the durability of existing spaces and buildings, reducing the amount of construction waste, and increasing the energy efficiency of buildings. The aim of this measure is to encourage cities and municipalities to base their projects on the revitalization and development of new urban areas on the principles of sustainability.							
Establishment of a Business Carbon Footprint Calculation and Reduction Program	Cross-cutting	CO <sub>2</sub>	Increasing energy efficiency, increasing RES utilization, promoting sustainable use of resources and the circular economy, and mitigating climate change by reducing GHG emissions from businesses	Regulatory	Planned	The following activities will be implemented within the measure: - improvement of the national carbon footprint model for businesses with an integrated database of national greenhouse gas emission factors, - the establishment and implementation of a voluntary program to calculate and reduce the carbon footprint of businesses from 2021, - monitoring and analysis of the achieved carbon footprint reduction of business entities, consideration will be given to the adoption of a by-law	2021	Ministry of Environment and Energy, The Environmental Protection and Energy Efficiency Fund					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						establishing the obligation to calculate the carbon footprint and developing an action plan for reducing the carbon footprint of business entities.							
Circular economy platform establishment	Cross-cutting	CO <sub>2</sub>	Integrating circular economy principles into plastics production and consumption, water management, food systems and special waste management	Information, Education, Regulatory	Planned	It is necessary to develop a systematic approach in all value chains that relate to the Croatian economy and relate to the measures outlined in the Circular Economy Action Plan, on the basis of which the EC integrates the principles of the circular economy in the production and consumption of plastics, water management, food systems and special waste streams. It is necessary to set up a cross-sectoral thematic working group to identify the stakeholders in the circular economy (focus on industry and suppliers of raw materials, energy and packaging) and draw up a national action plan for the transition to the circular economy by adapting the legislative framework. The inclusion of the representatives of the Republic of Croatia in the Stakeholder Platform for the European Circular Economy provides direct access to, and cooperation with, innovation and best practices.	2021	Ministry of Environment and Energy					
Bioeconomy platform establishment	Cross-cutting	CO <sub>2</sub>	In order to move to the bioeconomy, it is necessary to adapt the sectors of agriculture, forestry and waste management in order to balance the supply and demand for biomass, which includes the	Information, Education, Regulatory	Planned	In the context of bioeconomy development, it is necessary to link three key aspects: the development of new technologies and processes; market development and the competitiveness of biomass-based sectors and	2021	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Breaif description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
			establishment of collection and logistics centers for biomass and bio-refineries			the political will to co-operate with policy and stakeholders to achieve the bioeconomy in the Croatian context. This should ensure the transformation of existing "traditional" stakeholders of the bioeconomy (farmers, OPG, food processing, wood processing, pharmaceutical and chemical industries ...) into new, modern stakeholders whose products are no longer based on non-renewable carbon (bioplastics, biofuels, biochemicals, products of "traditional" stakeholders with a smaller carbon footprint ...) and prepare them for the announced EU funds for the transition to the bioeconomy. In order to move to the bioeconomy, it is necessary to adapt the sectors of agriculture, forestry and waste management in order to balance the supply and demand for biomass, which includes the establishment of collection and logistics centers for biomass and bio-refineries.							
Hydrogen technology platform establishment	Cross-cutting		Establishment of a hydrogen technology platform that will connect national stakeholders relevant to the research and application of hydrogen technology, monitor the development of hydrogen technologies at EU and international level and serve as a link between national, EU and international levels	Information, Education, Regulatory	Planned	The role of hydrogen in the energy and transport systems of the future is expected to be more significant, especially as the goals for reducing greenhouse gas emissions are more ambitious. It is therefore necessary to identify, in a timely manner, the opportunities associated with the use of hydrogen, to consider its use in the coming decade, and to explore the	2021	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						possibilities of financially stimulating hydrogen production and consumption. For that purpose, a hydrogen technology platform will be established, bringing together national stakeholders relevant to the research and application of hydrogen technology, monitoring the development of hydrogen technologies at EU and international level and serving as a link between national, EU and international levels.							
Energy Efficiency Obligation System for Suppliers*	Cross-cutting	CO <sub>2</sub>	Reduction of direct energy consumption and consequently reduction of CO <sub>2</sub> emissions	Regulatory	Implemented	Obligated parties of the energy efficiency obligation scheme are energy suppliers. The goal is to reduce energy consumption by end consumers.	2019	Energy Suppliers, Ministry of Environment and Energy					
Integrated energy efficiency monitoring information system*	Cross-cutting	CO <sub>2</sub>	Systematic monitoring of the implementation of energy efficiency measures and quantification of their effects; facilitated reporting at all levels; facilitating planning of new measures and revision of existing ones based on evidence of implementation effects	Information	Implemented	The national system for monitoring, measurement and verification of savings (SMIV) has been established, based on the Energy Efficiency Act and the Ordinance on the system for monitoring, measurement and verification of energy savings (OG 71/15). The system is extremely important because it monitors energy savings and the resulting reduction in greenhouse gases and the system data are used for reporting. In the next period, it is necessary to maintain and improve the functionality of the system, connect it to other systems (EMIS), and inform and educate obligated parties about the correct data entry	2015	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						required to calculate and verify energy savings.							
Green Public Procurement*	Cross-cutting	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O	Reducing energy consumption in public buildings; changes in the habits and behavior of users of public sector buildings	Information	Implemented	A National Green Public Procurement Commission was established to monitor the implementation of the Green Public Procurement through a survey questionnaire and an electronic public procurement classifieds. This measure is a continuation of the initiated measures and further greening of the public procurement procedures. Green public procurement will favor innovative low-carbon products and services, further boosting their entry into the market and serving as a good example.	2014	Ministry of Environment and Energy					
Determination of starting points, national targets, indicators for monitoring achievement and establishment of systems for monitoring the achievement of the set objectives of research, innovation and competitiveness	Cross-cutting	CO <sub>2</sub>	Defined national development goals in the context of low carbon transition, set up a system for monitoring achievement, defined key technologies	Regulatory	Planned	Elaboration of monitoring objectives and systems and establishment of a monitoring system for achievements in the field of energy-related research and development, innovation and competitiveness; defining key technologies for low carbon transition.	2020	Ministry of Environment and Energy, Ministry of Construction and Physical Planning, Ministry of Science and Education, Croatian Bureau of Statistics, State Intellectual Property Office					
Co-financing of industrial research and experimental development projects aligned with the National Development Strategy	Cross-cutting	CO <sub>2</sub>	Conducting research projects of priority for the Republic of Croatia	Economic	Planned	The measure encourages research and development of products and services relevant to low-carbon development by co-financing research projects under priority themes.	2021	Croatian Science Foundation, Ministry of Science and Education, Ministry of Construction and Physical Planning, HAMAG-BICRO, National Innovation Council					
Encouraging entrepreneurship	Cross-cutting	CO <sub>2</sub>	Low carbon products and services marketed	Economic	Planned	The measure encourages the development of	2021	HAMAG-BICRO, Ministry					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
development in the low carbon economy						entrepreneurship in the area of low-carbon products and services, by co-financing entrepreneurial activities in this area.		of Science and Education, Ministry of Construction and Physical Planning, Ministry of Environment and Energy					
Encouraging the knowledge and technology transfer from science to economy system with a focus on low carbon technologies	Cross-cutting	CO <sub>2</sub>	Low carbon products and services marketed	Economic	Planned	The measure encourages the development of established and functional technology transfer offices and science and technology parks with the aim of transferring knowledge and developing technologies that will contribute to the development of a low carbon economy.	2021	HAMAG-BICRO, Ministry of Science and Education, Ministry of Construction and Physical Planning, Croatian Chamber of Economy					
Encourage further work of scientific centers of excellence established in the field of natural, technical, biotechnical and biomedical sciences	Cross-cutting	CO <sub>2</sub>	Results of industrial and experimental research in the field of low carbon development	Economic	Planned	The measure encourages the continued work of established centers of excellence whose work has been positively evaluated in the periodic evaluation process with a view to further developing a low carbon economy.	2021	Ministry of Environment and Energy					
Capacity building to stimulate research and innovation and increase competitiveness in the low carbon economy	Cross-cutting	CO <sub>2</sub>	Capacities built into bodies responsible for stimulating research, innovation and competitiveness in the area of low carbon technologies	Information	Planned	The capacity of the institutions involved in stimulating and monitoring research, innovation and competitiveness in the low carbon economy will be built.	2020	HAMAG-BICRO, Ministry of Science and Education, Ministry of Construction and Physical Planning					
National Plan for the Increase of the Number of Nearly-Zero Energy Buildings*	Energy	CO <sub>2</sub>	The measure does not have a direct effect on reducing energy consumption, but rather supports the regulatory measure for the construction of new buildings to the nZEB standard, as well as a promotional energy renovation measure up to the nZEB standard, which will result in a measurable reduction in energy consumption, greater use	Information	Implemented	After 31st December 2020 all new buildings have to be built according to nearly zero energy (nZEB) standard for buildings, and all new buildings in which are owned or used by the public bodies should be built according to the nZEB standard after 31st December 2018. The above legal regulations ensure that all newly constructed buildings from 2021 onwards are in the nZEB	2014	Ministry of Construction and Physical Planning, Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
			of RES and avoided CO <sub>2</sub> emissions.			standard. However, in order to ensure the correct application of these regulations as well as to encourage energy renovation of buildings to the nZEB standard, a number of information and educational activities are planned in the next period to promote the construction and renovation of the nZEB standard.							
Program for energy renovation of the apartment buildings*	Cross-cutting	CO <sub>2</sub>	Improving energy efficiency in residential buildings	Economic	Implemented	This measure foresees the continuation for the implementation of The Program of Energy Renovation of Apartment Buildings for the Period from 2014 to 2020. For this purpose, it is necessary to plan ESI funds for the next programming period 2021-2027 (with implementation by 2030). Implementation procedures need to be significantly facilitated, especially in the area of public procurement implementation. The technical conditions should also remain as in the existing Program, therefore, it is necessary to achieve at least 50% reduction of the building's thermal needs. Upgrades to the nZEB standard need to be strongly encouraged. In addition, consideration should be given to setting up a special fund from which the costs will be reimbursed to energy-poor or at-risk-of-poverty households, to remove the barrier to securing sufficient co-ownership for energy renewal. The implementation of the Program must be	2014	Ministry of Construction and Physical Planning, Ministry of Environment and Energy, The Environmental Protection and Energy Efficiency Fund					

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									2020	2025	2030	2035	2040
						accompanied by strong promotional activities, assured technical assistance to applicants, and it is necessary to ensure that energy consumption is monitored before and after energy renewal, which requires the creation of prerequisites under ISGE. It is envisaged to renovate about 520,000 m <sup>2</sup> of apartment buildings per year.							
Program for the Energy Renovation of the Family Dwellings*	Energy	CO <sub>2</sub>	Improving energy efficiency in single family homes	Economic	Implemented	The program needs to be conceptualized as a continuation of the implementation of the Energy Efficiency Program for single-family homes from 2014 to 2020, with co-financing from the funds of the Environmental Protection and Energy Efficiency Fund. The primary sources of co-financing should be revenues from the auctioning of greenhouse gas emission units and revenues from the fees paid by suppliers in the energy efficiency obligation system in the event of default. The program should leave the possibility of implementing individual measures, but taking into account the order of implementation of the measures (eg the replacement of the heating system by a more efficient system using RES should only be allowed to those houses that have good thermal characteristics and do not need envelopes). Upgrades to the nZEB standard need to be strongly encouraged. The	2014	Ministry of Construction and Physical Planning, Ministry of Environment and Energy, The Environmental Protection and Energy Efficiency Fund					



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									2020	2025	2030	2035	2040
						implementation of the Program must be accompanied by strong promotional activities. About 350,000 m <sup>2</sup> of single-family homes are planned to be renovated annually.							
Program for the energy renovation of public buildings*	Energy	CO <sub>2</sub>	Improving energy efficiency in public sector buildings	Economic	Implemented	The measure represents a continuation of the implementation of the Energy Sector Building Renovation Program from 2016 to 2020. To this end, it is necessary to plan ESI funds for the next programming period 2021-2027 (with implementation by 2030). The funds should be planned to ensure the activation of private capital and the ESCO market, especially for buildings that are suitable for such financing models (continuous work buildings, such as hospitals, penitentiaries, nursing homes, etc.) and belonging to the category of central government buildings for which there is a binding renovation objective defined in Directive 2012/27 / EU on energy efficiency. Market models should be combined with grants to achieve the nZEB standard. In addition to ESI funds, the EPEEF is also required to plan funds for this Program in the part related to the co-financing of energy renovation of central government buildings under the ESCO model. For buildings that are not suitable for market models, it is necessary to provide grants under the same conditions as in the	2014	Ministry of Construction and Physical Planning, Ministry of Environment and Energy, The Environmental Protection and Energy Efficiency Fund					

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									2020	2025	2030	2035	2040
						previous program. Renovation of public sector buildings must be directed to the nZEB standard wherever technically feasible. About 350,000 m <sup>2</sup> of public buildings are planned to be renovated annually.							
Energy renovation program for buildings that have the status of a cultural property*	Energy	CO <sub>2</sub>	Energy savings and reduction of CO <sub>2</sub> emissions in buildings with cultural property status	Economic	Adopted	Protected buildings within the meaning of the Energy Restoration Program for buildings with the status of cultural property are those that can be classified into two categories: individually protected cultural property (individual building and architectural complexes) and buildings within a protected cultural and historical entity. The program does not cover buildings protected as a preventively protected cultural property, nor buildings as a registered cultural property. The Program has developed two basic approaches to the energy renovation of buildings that are the subject of this Program: a holistic (integral) approach and an approach with the application of individual energy renovation measures.	2020	Ministry of Construction and Physical Planning					
Public lighting renewal program*	Energy	CO <sub>2</sub>	Reduction of electricity consumption in public lighting systems, reduction of light pollution	Economic	Implemented	The energy renovation of public lighting in the Republic of Croatia is currently being carried out using ESI funds from the European Regional Development Fund, using the favorable interest rate loan facility offered by HBOR (JLP (R) S). A total of HRK 152 million is	2014	Ministry of Environment and Energy, Croatian Bank for Reconstruction and Development, The Environmental Protection and Energy Efficiency Fund					

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									2020	2025	2030	2035	2040
						available for this purpose and the loan covers up to 100% of the eligible project costs. It is anticipated that this financial allocation will be utilized by 2020 and by 2023 at the latest. The estimated savings of this first phase of the Program are about 15 GWh in 2020 (2023). Given the significant potential that exists in public lighting systems, it is planned to use ESI funds in the next programming period 2021-2027. By programming a larger allocation of funds for this purpose, existing potential could be utilized by the end of 2030, estimated at around 225 - 280 GWh. At the same time, the renovation of public lighting would meet the technical standards for the illumination of roads, which would improve transport safety and reduce light pollution.							
Systematic energy management in the public sector*	Energy	CO <sub>2</sub>	Reducing energy consumption in public buildings	Information	Implemented	The public sector in Croatia is obliged to systematically manage energy, which is specifically prescribed by the Energy Efficiency Act and the Regulation on Systematic Energy Management (OG 18/15, 06/16). The basis of the measure is the Energy Management Information System. The goal is to cover and regularly monitor all public sector buildings and public lighting systems by the end of 2030.	2014	Real estate agency, Ministry of Environment and Energy					
Energy management system in the business (service & production) sector	Energy	CO <sub>2</sub>	Reducing the energy consumption of businesses in the service and industrial sectors	Fiscal	Planned	Although large companies are obliged to carry out energy audits on a regular basis, this obligation does	2021	Ministry of Environment and Energy, Ministry of Finance					

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									2020	2025	2030	2035	2040
						not ensure continuous care for energy consumption in the enterprise nor does it cover small and medium-sized enterprises. In order to encourage businesses to introduce certified energy management systems (such as ISO 50001), a comprehensive analysis of the possibilities of using the tax system (including taxes and para-fiscal levies) will be developed by 2020 to encourage businesses to introduce such a system and thereby ensure continued care energy consumption.							
Information Accounts*	Energy	CO <sub>2</sub>	Increasing consumer awareness of energy consumption and, consequently, changing behavior with reduced energy consumption	Information	Implemented	One of the basic consumer information measures is a legal obligation for suppliers to provide consumers with information bills containing energy billing and end-customer prior consumption data for billing metrics subject to a contractual relationship, which include comparison with the average common or reference end customer from the same category of supplier end customers. It is desirable that the frequency of application of this legal provision is from an annual level of awareness to a monthly level and it is absolutely essential to ensure that the Energy Regulatory Authority (HERA) supervises these obligations of the energy supplier. In addition, on the basis of these regulatory provisions, it is also necessary to further inform consumers about the content and meaning of the bill, which is the task of the	2014	Ministry of Environment and Energy, Croatian Energy Regulatory Agency					

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									2020	2025	2030	2035	2040
						National Energy Efficiency Coordination Body.							
Information on energy efficiency*	Energy	CO <sub>2</sub>	Increasing the level of awareness of the benefits of energy efficiency with the consequent change in behavior and reduction of energy consumption by applying concrete measures	Information	Implemented	Information will be provided to the general public and target groups through the organization of targeted info-campaigns related to specific programs for promoting energy efficiency, in particular energy renovation of buildings. The NKT will maintain a national energy efficiency portal and, through the provision of up-to-date information, ensure the continued promotion of energy efficiency and energy services. Particular attention will have to be paid in the coming period to informing the consumer of the duties of the supplier under the obligation system.	2015	Ministry of Environment and Energy					
Energy efficiency education*	Energy	CO <sub>2</sub>	Available expert capacities for implementation of energy efficiency measures	Education	Implemented	Training will be achieved by continuing to implement the existing measure and adapting the activity to the needs and the real situation. It is especially important to work systematically to attract young people to the construction and other technical professions, which will in the long run contribute to the availability of expert capacities for the implementation of energy renovation of buildings, which is the basis for achieving the set energy-climate goals. Through the education in the field of energy efficiency, the principles of green building will be set and applied: the promotion and implementation of green	2012	Agency for Vocational Education and Training and Adult Education, Croatian Employment Service, CROSKILLS project (Faculty of Civil Engineering in Zagreb), Ministry of Construction and Physical Planning					

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									2020	2025	2030	2035	2040
						building (building on the principles of sustainability) as an essential segment of sustainable development and the circular economy should be encouraged.							
Energy efficiency of the electricity transmission system*	Energy	CO <sub>2</sub>	Reduction of losses in the transmission network	Economic, Other (Organizational)	Implemented	Current levels of losses in the transmission network of the Republic of Croatia amount to about 2% of the transmitted electricity, which is the amount at the level of other operators of the transmission system ENTSO-E. An important feature of the Croatian transmission network, both in terms of plant safety and support of market activities, as well as in terms of losses, is its extremely strong connection with neighboring power systems (interconnections). While, on the one hand, this significantly increases the security of the drive, on the other hand, the transit increases the network losses. HOPS will continue to implement measures related to the operation of the EES plant and measures related to the development of the transmission network until 2030, with the aim of further reducing technical losses in the network. For this measure, it is proposed, in addition to securing funding from HOPS, to program the use of ESI funds in the next programming period from 2021 to 2027.	2014	Croatian Transmission System Operator, Ministry of Environment and Energy					
Reducing losses in the electricity distribution network and introducing advanced networks*	Energy	CO <sub>2</sub>	Reducing losses in the distribution network	Economic, Other (Organizational)	Implemented	HEP-ODS will continue to carry out activities to reduce technical and non-technical losses in the distribution electricity grid	2014	HEP-Distribution System Operator, Ministry of Environment and Energy, Croatian					

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									2020	2025	2030	2035	2040
						until 2030. A detailed analysis will identify the causes of increased losses in some parts of the network and the priorities for implementing activities to reduce technical and non-technical losses. Based on the experience of implementing the pilot project of introducing advanced networks in pilot areas using ESI funds, it is necessary to program the continued use of ESI funds in the next programming period from 2021 to 2027 for the further development of advanced networks.		Energy Regulatory Agency					
Increasing the efficiency of the heating system*	Energy	CO <sub>2</sub>	Loss Reduction in Central heat systems	Economic, Other (Organizational)	Implemented	In the existing large district heating systems, a large source of losses is the dilapidated distribution network and this measure foresees the continuation of the replacement of pipelines and steam pipelines with the dilapidated insulation of steel pipelines with new pre-insulated pipes and technological shift towards the fourth generation of district heating. In smaller systems with own boiler rooms, it is necessary to enable the reconstruction of boiler rooms, in particular by replacing high-efficiency cogeneration systems or systems using heat pumps. The measure also envisages the development of new heating and cooling systems, which use high-efficiency cogeneration or renewable energy sources. In view of the provisions of Directive 2018/2002 on energy efficiency, and in	2014	Central heat system operators, Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						particular with the introduction of the obligation of individual measurement at the end-user level, district heating systems have become systems with variable heat demand, which requires the introduction of advanced metering systems as an additional step towards the integration of different energy systems and increasing overall energy efficiency.							
Increasing the efficiency of the gas system*	Energy	CO <sub>2</sub>	Reducing losses in the gas transportation system	Economic, Other (Organizational)	Implemented	The potential for increasing the energy efficiency of the gas transmission system is the largest in the consumption of natural gas, which is mostly (70%) consumed for preheating of natural gas before delivery to customers, and only a smaller part (30%) for heating of business premises and various technological burdens, ie blowing out the system. In the coming period, Plinacro will carry out energy efficiency improvement activities in accordance with the Ten-Year Plan for the Development of the Croatian Gas Transmission System 2018-2027.	2014	Plinacro, Ministry of Environment and Energy, Croatian Energy Regulatory Agency					
Information, education and capacity building for the use of renewable energy sources	Energy	CO <sub>2</sub>	Increase in energy production and the share of RES in total energy consumption and reduction of GHG emissions from the energy sector and the above target sectors/Increasing the number of citizens interested in using RES	Information	Planned	Informing will be provided to the general public and target groups through the organization of targeted information campaigns related to investing in systems that use renewable energy sources, especially in systems intended for their own use. Information, education and capacity building for RES will be	2021	Ministry of Environment and Energy, The Environmental Protection and Energy Efficiency Fund, Ministry of Construction and Physical Planning, Croatian Chamber of Economy					



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									2020	2025	2030	2035	2040
						implemented at national level.							
Space-planning regulation preconditions for the use of renewables	Energy	CO <sub>2</sub>	Increasing the installed capacity of RES into the next generation spatial plan, with sustainable use of space and natural resources (acceptable environmental and environmental impacts) and reducing greenhouse gas emissions	Regulatory	Planned	Defining guidelines and criteria for the organization of specific spatial-functional elements for the use of RES, improved and cross-sectoral harmonization of spatial-planning conditions for determining the space suitable for the construction of RES plants at the state, county and local level. Guidelines and criteria will be adopted for determining the spatial-planning conditions for the use of space intended for the construction of RES facilities (specific spatial-functional elements in space) and for the exploitation fields of geothermal water for energy purposes. The conditions for determining the location and construction of RES plants will be integrated into the spatial plans of all counties.	2021	Ministry of Construction and Physical Planning, Ministry of Environment and Energy					
Encouraging the use of renewables for electricity and heat production*	Energy	CO <sub>2</sub>	The measure will ensure an increase in energy production and a share of RES in total energy consumption and, consequently, a reduction in GHG emissions. It also creates preconditions for the establishment of a monitoring system to meet the sustainability criteria and the expected reductions in greenhouse gas emissions from biomass plants.	Economic	Implemented	Provision of financial incentives for the development of RES projects for electricity and heat production. Encouraging the use of RES for electricity and heat production will be implemented at national level.	2009	Ministry of Environment and Energy, Croatian Energy Market Operator, The Environmental Protection and Energy Efficiency Fund, Ministry of Agriculture, Croatian Hydrocarbon Agency					
Develop a regulatory framework for the use of renewables	Energy	CO <sub>2</sub>	The result of the implementation of the measure is a functional RES market and an	Regulatory	Planned	The existing legal framework needs to be supplemented and procedures and practices	2021	Ministry of Environment and Energy, Ministry of Construction					

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									2020	2025	2030	2035	2040
			increase in energy production and a share of RES in total energy consumption			developed. The goal by 2022 is to fully adopt the regulatory framework and established procedures at national level.		and Physical Planning, Ministry of State Property, Croatian Energy Regulatory Agency					
Integrated energy source and energy security planning*	Energy	CO <sub>2</sub>	Security of energy and energy supply	Regulatory	Adopted	A top measure for increasing energy security is integrated security of supply planning, in the context of all energy products and all energy systems. Integrated planning must be harmonized at local, regional and national level, and in accordance with energy planning carried out by energy entities for energy infrastructure across the territory of the Republic of Croatia. In addition, integrated planning needs to be aligned with alternative fuel planning and alternative fuel infrastructure. This planning will be carried out within the framework of the revision of the Integrated Energy and Climate Plan, which must be completed by 23 June 2023, and in the framework of the preparation and revision of the following plans. To this end, it is necessary to supplement the existing regulatory framework.	2021	Ministry of Environment and Energy					
Construction and use of energy storage tanks	Energy	CO <sub>2</sub>	Security of energy and energy supply	Economic	Planned	In order to increase the energy storage capacity of the system and increase the regulatory capacity of the electricity system, it is planned to build additional reversible power plants with a capacity of 150 MW before 2030, then the development of heat	2021	Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						storage tanks for end customers, the development of battery tanks, the introduction of charging stations for electric vehicles that allow energy storage and the use of other innovative energy storage technologies (EU-funded).							
Development and maintenance of central heat production system*	Energy	CO <sub>2</sub>	Increasing the energy efficiency of end-user production units, infrastructure and equipment, and increasing reliability and security of supply	Economic	Implemented	Centralized thermal systems have been identified as one of the priorities of the energy policy of the Republic of Croatia. The most significant potential for the development and improvement of the existing centralized thermal systems is primarily in increasing the energy efficiency of production units, infrastructure and equipment for end users and increasing the reliability and security of supply. Therefore, this measure oversees the maintenance and upgrading of existing CTS systems, stopping the trend of disconnecting customers from the CTS system, introducing heat storage tanks for electricity, and using RES for CTS and replacing existing CTS production with renewable sources (eg biofuels), using heat pumps.	2014	Ministry of Environment and Energy					
Construction of LNG terminal*	Energy	CO <sub>2</sub>	Security of energy and energy supply	Economic	Adopted	The size of the LNG terminal depends on market interest and the first phase is planned to build an FSRU ship (ship for gas storage and gasification) with a maximum annual natural gas supply of up to 2.6 billion cubic meters.	2021	Ministry of Environment and Energy, LNG Hrvatska Ltd.					

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									2020	2025	2030	2035	2040
						The planned maximum capacity of natural gas deliveries from the terminal, and indirectly its size and capacity, is conditioned on the maximum capacity of the gas pipeline system, which, with the construction of the first part of the evacuation pipeline system; Omišalj-Zlobin gas pipeline amounted to 7.2 million m3/day. With the construction of the extension of the Zlobin-Kozarac evacuation pipeline, the total capacity of the UPP terminal would increase to 12 million m3/day, and with the additional construction of the Kozarac-Slobodnica pipeline the capacity would increase to 19 million m3/day. It is estimated that the total investment for the construction of the first phase of the LNG terminal would be just over HRK 1.7 billion, with the planned start up on January 1st 2021.							
Refinery modernization	Energy	CO2	Reducing fugitive emission	Economic	Planned	Implementation of investments in modernization and improvement of production in order to maintain the competitiveness of refineries.	2021	INA Ltd., Ministry of Environment and Energy,					
Measures to increase energy efficiency by improving processes and process units*	Energy	CO2	Reducing fugitive emission	Economic	Implemented	Increasing energy efficiency is achieved by implementing measures that contribute to reducing energy intensity through more rational use of energy and raw materials and by altering production processes and equipment at pumping stations and	2016	INA Ltd., Ministry of Environment and Energy,					

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									2020	2025	2030	2035	2040
						refineries, which contributes to reducing fugitive emissions.							
Methane flaring	Energy	CO <sub>2</sub>	Reducing fugitive emission	Economic	Planned	In order to reduce fugitive emissions, instead of fuming methane, methane is burned on a torch. In this way, methane emissions are reduced by 95-99% depending on the efficiency of the flares.	2021	INA Ltd., Ministry of Environment and Energy,					
Development of the Transmission Power Network*	Energy	CO <sub>2</sub>	Safe and reliable operation of the electricity transmission network	Economic	Implemented	Croatian Transmission System Operator d.o.o. (hereinafter referred to as: HOPS) is, under the Energy Act (OG 120/12; 14/14; 95/15; 102/15, 68/16), the energy entity responsible for the management, operation and operation, maintenance, development and construction portable electricity networks. Pursuant to the Electricity Market Act (OG 22/13, 95/15 and 102/15, 68/18, 52/19), HOPS, as the owner of the 110 kV to 400 kV transmission network, is obliged to produce and adopt, with the prior consent Croatian Energy Regulatory Agency (hereinafter: HERA), ten-year, three-year and one-year investment plans for the development of the transmission network. Ten-year development plans are updated annually. At the time of adoption of this document, the Ten-Year Transmission Network Development Plan 2019-2028 was relevant, with detailed elaboration for the initial three-year and one-year periods approved by HERA in July 2019. The plan will be continuously	2014	Croatian Transmission System Operator, Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						updated throughout the implementation period of this document.							
Development of the gas transmission system*	Energy	CO <sub>2</sub>	Safe and reliable operation of the gas transmission system	Economic	Implemented	Planning for the development of the transmission system is carried out through the development of a 10-year plan for the development of the gas transmission system, the development of which is the obligation of the gas transmission system operator pursuant to the Gas Market Act (OG 18/18). The gas transmission system operator is Plinacro d.o.o. The ten-year gas transportation system development plans are updated annually and approved by HERA. At the time of adoption of this document, the Ten-Year Plan for the Development of the Gas Transportation System of the Republic of Croatia 2018-2027 was relevant. The plan will be continuously updated.	2014	Plinacro, Ministry of Environment and Energy					
Development of the regulatory framework for the electricity market and active participation of customers on the electricity market	Energy	CO <sub>2</sub>	The emergence of aggregators in energy markets; the emergence of new energy markets	Regulatory	Planned	In order to enable the active role of network users in the electricity market, the existing regulatory framework should be appropriately amended and supplemented, in particular by introducing an aggregator as a market player and by facilitating the launch of a pilot ancillary service project. Pilot projects will analyze in detail the services that users can provide to the distribution or transmission system operator. The possible types, extent, manner and period of the	2021	Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						provision of ancillary services will be analyzed. Obstacles to the use of ancillary services will be identified and ways to remove them will be suggested. The potential for the provision of ancillary services and flexicurity services by network users will be carried out beforehand, which will define the manner and model of the provision of ancillary services and consumption responses by network users.							
Introduction of advanced measuring systems and advanced measured data management	Energy	CO <sub>2</sub>	Introduction of advanced measuring devices and systems at the level of electricity consumption	Regulatory	Planned	In order to enable the active role of network users in the electricity market, the existing regulatory framework should be appropriately amended and supplemented, in particular by introducing an aggregator as a market player and by facilitating the launch of a pilot ancillary service project. Pilot projects will analyze in detail the services that users can provide to the distribution or transmission system operator. The possible types, extent, manner and period of the provision of ancillary services will be analyzed. Obstacles to the use of ancillary services will be identified and ways to remove them will be suggested. The potential for the provision of ancillary services and flexicurity services by network users will be carried out beforehand, which will define the manner and model of the provision of ancillary services and	2021	Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						consumption responses by network users.							
Adoption and implementation of the Energy Poverty Reduction Program*	Energy	CO <sub>2</sub>	Establishment of a system for monitoring energy poverty and its vulnerability	Information, Economic, Regulatory	Implemented	Mitigating energy poverty and its vulnerability; setting up an energy poverty monitoring system.	2017	Ministry of Environment and Energy, Ministry of Demography, Family, Youth and Social Policy					
Providing information to consumers on fuel economy and CO <sub>2</sub> emission of new passenger cars *	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Regulatory	Implemented	Pursuant to the Ordinance on Availability of Information on Fuel Economy and CO <sub>2</sub> Emissions from Passenger Cars (OG 7/15) each supplier of new passenger cars intended for sale shall provide consumers with information on the fuel consumption rate and specific CO <sub>2</sub> emission of passenger cars. The Ministry of Interior which is responsible for the road transport safety, on the basis of the Ordinance once a year, not later than 31 March of the current year, makes a Guidelines on cost-effectiveness of fuel consumption and CO <sub>2</sub> emission from new passenger cars available for purchase on the market in the Republic of Croatia. The Guidelines contains required information for each model of new passenger cars available in the domestic market.	2015	Ministry of the Interior					
Special fee for environment on the motor vehicles*	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Regulatory, Fiscal	Implemented	The existing system of payment of the special environmental fee for motor vehicles is regulated by the Law on the Environmental Protection and Energy Efficiency Fund (OG 107/03, 144/12), the Statut on unit fees, corrective coefficients and the related criteria and	2014	Ministry of Environment and Energy, The Environmental Protection and Energy Efficiency Fund					



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									2020	2025	2030	2035	2040
						criteria for determining the special environmental fee to motor vehicles (OG 114/14, 147/14). A special fee is charged taking into account the type of engine and fuel, engine capacity, vehicle type, CO <sub>2</sub> emissions and age of the vehicle.							
Special tax on motor vehicles*	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Regulatory, Fiscal	Implemented	Based on the polluter pays principle, the calculation model is based on the emission of CO <sub>2</sub> into the air from motor vehicles. The special tax is determined on the basis of the sales or market price of the motor vehicle, the CO <sub>2</sub> emissions expressed in grams per kilometer, the engine volume in cubic centimeters and the level of greenhouse gas emissions. This special tax encourages the purchase of efficient vehicles and vehicles with lower greenhouse gas emissions. The enactment of the Special Motor Vehicle Tax Act (OG 15/13, 108/13, 115/16, 127/17) ensured the implementation and enforcement of the measure.	2014	Ministry of Environment and Energy, Ministry of Finance					
Monitoring, reporting and verification of greenhouse gas emissions in the lifetime of liquid fuels*	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Regulatory	Implemented	In accordance with the Air Protection Act (OG 130/11, 47/14, 61/17), a supplier placing fuel on the domestic market will monitor greenhouse gas emissions per unit of energy for the duration of the fuel. Suppliers should draw up a report to be verified and submitted to the Ministry of Environment and Nature -	2017	Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						Institute for Environmental and Nature Protection.							
Legislative adjustments for cleaner transport	Transport	CO <sub>2</sub>	Accelerating the development of the alternative energy market, increasing the share of RES in final energy consumption in transport, increasing the share of clean vehicles in road transport	Regulatory	Planned	Amend laws and by-laws to ensure the development of alternative fuel infrastructure, to increase the share of renewable sources in direct energy consumption in transport, and to promote clean and energy-efficient vehicles in road transport.	2021	Ministry of Environment and Energy					
Financial incentives for the purchase of energy efficient vehicles*	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Economic	Implemented	In the context of co-financing cleaner transport projects, it is necessary to define specific co-financing lines for specific purposes for the purchase of vehicles powered by electricity, CNG/CBG, LNG/LBG and hydrogen. Incentive co-financing measures for vehicle procurement should be carried out consistently and continuously, focusing primarily on alternative fuels for which an assessment of the existing situation showed a low representation of vehicles in the total number of vehicles, and will be limited in time until monitoring shows a minimal representation of vehicles. The minimum market launch will be considered to be a 1 percent share of alternative fuel vehicles in the total number of vehicles registered in the country.	2014	The Environmental Protection and Energy Efficiency Fund, Ministry of Environment and Energy					
Development of infrastructure for alternative fuels*	Transport	CO <sub>2</sub>	Accelerating the development of alternative energy markets	Economic	Implemented	The objective of this measure is to facilitate the uptake of alternative fuels by users/consumers by strengthening the alternative fuels distribution infrastructure	2015	The Environmental Protection and Energy Efficiency Fund, Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						and implementing common technical specifications for this infrastructure. The measure follows Directive 2014/94/EU on the establishment of alternative fuel infrastructure, the Law on the establishment of alternative fuel infrastructure (OG 120/16) and the National Policy Framework for the Establishment of the Infrastructure and the Market for Alternative Fuels in Transport (OG 34/17; NOP) and encourages the construction of filling stations in accordance with the aforementioned documents. This infrastructure measure will not directly affect the reduction of fuel consumption in transport, but certainly the development of infrastructure is a necessary prerequisite for the development of markets for vehicles and vessels using electricity, CNG/CBG, LNG/LBG and hydrogen in Croatia. The incentive measures for infrastructure co-financing will be primarily oriented towards alternative fuels for which an assessment of the existing situation has shown that the infrastructure is underdeveloped and will be limited in time until monitoring shows a minimum coverage of the infrastructure. The minimum infrastructure coverage will be considered to be the one that meets the							

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						objectives of the minimum NOP infrastructure.							
Promotion of integrated system for the transport of goods*	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Regulatory, Economic	Implemented	The measure is regulated by the Combined Carriage of Goods Act (OG 120/16), or the Ordinance on Incentives in Combined Carriage of Goods (OG 5/18), which stipulates incentives in combined transport of goods by rail, inland water or sea, and incentives in combined transport freight by road section.	2016	Ministry of Environment and Energy					
Encouraging the development of sustainable integrated transport at national level*	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Information, Other (Organizational)	Implemented	The measure monitors the general and specific objectives defined in the Transport Development Strategy of the Republic of Croatia (2017 - 2030) in the context of energy efficiency of rail, road, maritime, inland waterway and urban, suburban and regional transport (railway modernization, signaling system, renewal fund of locomotives, wagons, fleet of vessels, logistic integrated platforms, integrated public transport of passengers, etc.). Rail and generally multimodal infrastructure are lagging behind in comparison to highway infrastructure in terms of quality and connectivity. Investments are planned to develop a sustainable, integrated trans-European climate-resilient transport network. In maritime and inland waterway transport, the Republic of Croatia, in consultation with the other Member States, will analyze the feasibility of introducing appropriate	2019	Ministry of the Sea, Transport and Infrastructure, Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						mechanisms to ensure the transition to low carbon solutions, in particular with regard to the application of alternative energy sources for navigation. In this context, an action plan for shipping will be defined, which will define appropriate emission standards for the coming period. Also, in air transport, the Republic of Croatia will define a plan and elaborate detailed guidelines for achieving significant reductions in greenhouse gas emissions.							
Promoting integrated and intelligent transport and developing local and regional alternative fuel infrastructure*	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Information, Other (Organizational)	Implemented	It is necessary to promote the sustainable development of urban transport systems by optimizing freight transport logistics and intelligent management of public parking areas (ICT technologies), introducing integrated passenger transport, introducing car-sharing schemes in cities, introducing low-emission zones in cities, introducing public transport systems for urban bicycles and construction of associated bicycle infrastructure, intelligent transport management (upgrading, adaptation and replacement of obsolete signaling devices and equipment, installation of advanced transport equipment and intelligent transport lights equipped with an autonomous renewable energy system, construction and equipping of central operational centers for the control and management of	2019	The Environmental Protection and Energy Efficiency Fund, Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						intersections with transport lights set). At local levels, continuous development and implementation of Sustainable Urban Mobility Plans and/or Strategic Plans, which build on existing planning practices and take into account integration, participatory and evaluation principles, are needed to meet the needs of urban residents for mobility, now and future, and ensure a better quality of life in and around cities. The activities will be accompanied by appropriate outreach campaigns.							
Training for drivers of road vehicles for eco-driving*	Transport	CO <sub>2</sub>	Energy savings, CO <sub>2</sub> e emission reduction, pollutant emission reduction	Information	Implemented	The aim of the measure is to raise awareness of the benefits of energy-efficient driving. Education on eco-driving elements is carried out by short trainings (lasting about 60-120 minutes per candidate) among drivers who have obtained a driver's license prior to the entry into force of the Ordinance on the training of candidates for drivers (OG 13/09, 132/17), whereby an obligation for all driving schools and instructors to undertake eco-driving training during the candidate's standard driver training. Specific elements of the national campaign should be dedicated to eco-driving education for drivers of passenger cars, buses, commercial and heavy goods vehicles.	2011	The Environmental Protection and Energy Efficiency Fund, Ministry of Environment and Energy					
Encouragement of alternative fuel use	Transport	CO <sub>2</sub>	Accelerating the development of active users of alternative	Economic	Adopted	In accordance with the National Coastal Maritime Transport Development	2021	The Environmental Protection and					

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									2020	2025	2030	2035	2040
in ship transport system*			energy, saving energy and reducing CO <sub>2</sub> emissions and reducing pollutant emissions			Plan and considering that the Republic of Croatia is a maritime country with developed long-distance liner transport, and in addition has navigable river routes and lakes, this measure would co-finance projects for the gradual transition of the existing obsolete fleet to alternative and/or hybrid solutions and new construction. Ships using alternative fuels are generally more expensive than ships using conventional fuels, so there is no expressed interest of shippers to invest in such ships. Therefore, it is necessary to financially support the conversion/construction of such vessels to the extent that the purchase price is equalized or puts such a ship in the same position as a ship using conventional fuel ships. This measure builds on the measure related to the development of alternative fuel infrastructure in terms of end users/consumers on that infrastructure, while significantly affecting the potential reduction of pollution of the sea, rivers and lakes.		Energy Efficiency Fund, Ministry of the Sea, Transport and Infrastructure					
Advanced Biofuel Market Development Plan*	Transport	CO <sub>2</sub>	Accelerating the development of the advanced fuel market and increasing the share of RES in final energy consumption in transport and reducing emissions in transport/Reducing the carbon footprint of bioeconomy stakeholders	Regulatory, Other (Promotional)	Adopted	Increase of RES share in transport by 2030 development of the advanced fuels market and achievement of the planned share of advanced fuels in direct energy consumption in transport through the least cost criteria and the largest multiplier. The implementation of the measure is based on	2021	Ministry of Environment and Energy, Ministry of Agriculture, Ministry of Economy, Ministry of Finance					

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									2020	2025	2030	2035	2040
						amendments to the relevant laws and bylaws based on the Directive on the promotion of the use of energy from renewable sources, and in particular to establish conditions for monitoring the sustainability of biofuels and greenhouse gas savings.							
Reduction of clinker content in cement production*	Industry/industrial processes	CO <sub>2</sub>	GHG emission reduction/Energy efficiency improvements/Economic viability	Economic, Other (Environmental)	Implemented	Increasing the proportion of mineral additives in cement depending on the composition of the raw material, the availability of additives of the appropriate composition on the market and the market requirements for certain types of cement.	2014	Cement production operators					
Limiting fluorinated greenhouse gas emissions*	Industry/industrial processes	HFCs, PFCs, SF <sub>6</sub>	Reduction of fluorinated GHG emissions	Regulatory, Other (Environmental), Economic, Education	Implemented	Implementation of Regulation (EU) No 517/2014 in the Republic of Croatia is regulated by the Law on Implementation of Regulation (EU) No 517/2014 of the European Parliament and of the Council on April 16th 2014 regarding fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 (OG 61/17, 118/18), effective from January 1st 2019. The measure defines activities and procedures for the prevention of fluorinated greenhouse gas emissions, conducting equipment leakage checks, use of equipment with leakage detection systems, keeping records of equipment on which leakage checks should be carried out, collection of fluorinated greenhouse gases to ensure their recovery, recovery or	2019	Ministry of Environment and Energy, Ministry of Finance (Customs Administration)					



Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						elimination, the development of a producer responsibility system for the collection of fluorinated greenhouse gases and their renewal, recovery or destruction, and the implementation of training and certification programs.							
A gradual decrease in the amount of hydrocarbons put on the market*	Industry/industrial processes	HFCs, PFCs, SF6	Reduction of fluorinated GHG emissions	Regulatory, Other (Promotional), Other (Environmental), Economic, Education	Implemented	Implementation of Regulation (EU) No 517/2014 in the Republic of Croatia is regulated by the Law on Implementation of Regulation (EU) No 517/2014 of the European Parliament and of the Council on April 16th 2014 regarding fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 (OG 61/17, 118/18), effective from January 1st 2019. The measure defines activities and procedures for the prevention of fluorinated greenhouse gas emissions, conducting equipment leakage checks, use of equipment with leakage detection systems, keeping records of equipment on which leakage checks should be carried out, collection of fluorinated greenhouse gases to ensure their recovery, recovery or elimination, the development of a producer responsibility system for the collection of fluorinated greenhouse gases and their renewal, recovery or destruction, and the implementation of training and certification programs.	2019	Ministry of Environment and Energy, Ministry of Finance (Customs Administration)					
Restrictions and prohibitions on placing certain	Industry/industrial processes	HFCs, PFCs, SF6	Reduction of fluorinated GHG emissions	Regulatory, Other (Environmental),	Implemented	Implementation of Regulation (EU) No 517/2014 in the Republic of	2019	Ministry of Environment and Energy, Ministry					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
products and equipment on the market*				Economic, Education		Croatia is regulated by the Law on Implementation of Regulation (EU) No 517/2014 of the European Parliament and of the Council on April 16th 2014 regarding fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 (OG 61/17, 118/18), effective from January 1st 2019. The measure defines activities and procedures for the prevention of fluorinated greenhouse gas emissions, conducting equipment leakage checks, use of equipment with leakage detection systems, keeping records of equipment on which leakage checks should be carried out, collection of fluorinated greenhouse gases to ensure their recovery, recovery or elimination, the development of a producer responsibility system for the collection of fluorinated greenhouse gases and their renewal, recovery or destruction, and the implementation of training and certification programs.		of Finance (Customs Administration)					
Reduction of fluorinated greenhouse gas emissions from mobile air-conditioning systems*	Industry/industrial processes	HFCs, PFCs, SF6	Reduction of fluorinated GHG emissions	Regulatory, Other (Environmental)	Implemented	Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 on emissions from the air-conditioning system in motor vehicles and amending Council Directive 70/156/EEC was implemented in three stages. The last phase came into force on January 1st 2017 by limiting the possibility of retrofitting air conditioning equipment designed to contain fluorinated greenhouse	2017	Ministry of Environment and Energy					

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									2020	2025	2030	2035	2040
						gases with a global warming potential of more than 150 in motor vehicles, and prohibiting the charging of air conditioning equipment with those gases.							
Change in livestock diet and feed quality	Agriculture	CH <sub>4</sub> , N <sub>2</sub> O	Reduction of methane emissions from intestinal fermentation and excretion of methane and nitrogen from manure management through changes in diet and changes in animal feed composition/Improving the emissions reporting system	Information, Education, Economic	Planned	The objective of the measure is to reduce methane emissions from intestinal fermentation and the extraction of methane and nitrogen from manure management through changes in diet and changes in the composition of animal feed; improving the emissions reporting system. Emissions of greenhouse gases from livestock production are a direct consequence of the intestinal fermentation and decomposition processes of manure or are indirectly generated during food preparation or other farm operations. Therefore, the measures taken to reduce greenhouse gas emissions are aimed at regulating digestive processes. In practice, many measures are most often applied at the same time, some of them acting simultaneously on intestinal fermentation but also reducing emissions during the handling of manure. There are various measures that can have a significant impact on emission reductions, some of which are already being implemented and some are expected in the reference scenario. By 2020, further work is expected on the implementation and synergy of dietary change activities, the treatment of	2020	Ministry of Agriculture					

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						feeds with the aim of increasing their digestibility and the use of additives (additives) in animal feed. It is further possible to further reduce greenhouse gas emissions by implementing targeted sub-measures of dietary change, as well as improving the quality of bulk feeds and improving the feeding system.							
Improving cattle facilities and systems of animal waste management	Agriculture	CH <sub>4</sub>	Reduction of methane, nitrogen and ammonia emissions through improvements in animal nutrition, and manure collection and storage systems	Information, Education	Planned	The objective of the measure is to reduce methane, nitrogen and ammonia emissions through improvements in animal nutrition and manure collection and storage systems. The fertilizer management category is the source of emissions of nitrogen compounds, ammonia and particulates. The emission comes from the excreta of animal fertilizer deposited in and around the dwellings and collected as liquid slurry, solid fertilizer or fertilizer in a yard with the latter two being viewed together as solid fertilizers. Emissions come from animal housing and from the yard, from storage areas and from the application of fertilizer to the soil and during grazing.	2020	Ministry of Agriculture					
Modification of livestock rearing system	Agriculture	CH <sub>4</sub> , N <sub>2</sub> O	Indirect reduction of methane and nitrous oxide emissions by increasing the share of cattle in the cow-calf system	Information, Education, Economic	Planned	Measures that have indirect effects on reducing greenhouse gas emissions relate to measures that increase the intensity of production per animal and per unit of time.	2020	Ministry of Agriculture					
Anaerobic decomposition of	Agriculture	CH <sub>4</sub> , N <sub>2</sub> O	Reduction of methane emissions from cattle and pig manure management	Information, Education, Regulatory	Planned	The introduction of biogas plants results in the reduction of CH <sub>4</sub> emissions	2020	Ministry of Agriculture					

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manure and biogas production			systems by increasing the share of biogas plants			due to the use of litter as a renewable source and the production of electricity.							
Improving the breeding program, animal health and welfare	Agriculture	CH <sub>4</sub> , N <sub>2</sub> O	Indirect reduction of methane and nitrous oxide emissions through breed improvements and enhancement of genetic potential	Information, Education, Economic	Planned	The aim of the measure is to determine both phenotypic and genetic variations in predicted CH <sub>4</sub> emissions and to determine the potential of genetics to reduce CH <sub>4</sub> emissions in dairy cows, as well as increased production intensity.	2020	Ministry of Agriculture					
Improvement and change of soil tillage system (reduced tillage)	Agriculture	CO <sub>2</sub>	Increasing soil carbon sequestration through improvements and modifications to soil treatment systems	Information, Education	Planned	Reduced tillage is the result of scientific research and practical checks that result in a change to the conventional tillage system by reducing the depth of tillage, omitting one or more work operations, reducing the frequency or completely omitting tillage, reducing the area under cultivation and retaining plant residues. The direct impact on greenhouse gas emissions is primarily related to the significant impact on soil organic carbon content and the reduced machine hours.	2020	Ministry of Agriculture					
Extension of rows with a higher proportion of legumes	Agriculture	CO <sub>2</sub>	Defining the potential for organic matter content change/increasing soil carbon sequestration by crop rotation	Information, Education	Planned	Sowing leguminous crops binds atmospheric nitrogen, reduces the risk of groundwater contamination, soil is enriched with organic matter, which has multiple positive effects on improving and maintaining the favorable physical, chemical and biological properties of the soil.	2020	Ministry of Agriculture					
Intensification of crop rotation using intermediate crops	Agriculture	CO <sub>2</sub>	Changes in organic matter content/increase of carbon sequestration in soil and reduction of nitrate leaching by	Information, Education, Regulatory	Planned	Sowing intermediate crops that can be used to feed livestock or plow for green fertilization will utilize the remaining nutrients, prevent further evaporation	2020	Ministry of Agriculture					

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									2020	2025	2030	2035	2040
			sowing of intermediate crops			of soil water, reduce carbon loss from soil, prevent nitrogen leaching into groundwater and increase soil organic matter.							
Improvement of mineral fertilizer application methods	Agriculture	N <sub>2</sub> O	Reduction of nitrous oxide emissions from agricultural soils due to optimization of mineral fertilizer application	Information, Education	Planned	Reducing the use of mineral fertilizers is an indirect benefit from other measures that reduce the need for their application, but with proper fertilization practices. The use of fertilizers can also directly affect the total amount of mineral fertilizers applied.	2020	Ministry of Agriculture					
Improvement of organic fertilizer application methods	Agriculture	N <sub>2</sub> O	Research on increasing carbon sequestration in soil by improving the methodology of application of organic fertilizers	Information, Education	Planned	Organic fertilizers originate from organic sources such as solid manure or slurry and plant and animal residues, and more strongly stimulate soil microbial activity compared to mineral fertilizers. Using direct injection into the soil reduces nitrogen loss due to volatilization.	2020	Ministry of Agriculture					
Agroforestry	Agriculture	CO <sub>2</sub>	Defining the potential and benefits of various agroforestry technologies to increase soil carbon sequestration	Information, Education	Planned	Agroforestry is a common name for land management systems whereby permanent woody species are integrated with the cultivation of crops and/or animals on the same area unit. Certain agroforestry systems (eg agro-silviculture) are significant carbon outflows. It is necessary to establish through the experiment the applicability of agroforestry in our conditions with regard to different forms and divisions, but also to different needs.	2020	Ministry of Agriculture					
Hydromelioration interventions and systems for protection against disasters	Agriculture	N <sub>2</sub> O	Increasing the share of agricultural soils under irrigation and consequently reducing	Information, Education	Planned	With the controlled application of mineral fertilizers, controlled drainage, re-use of drained water and the use of water	2020	Ministry of Agriculture					

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			the leaching of nitrates from agricultural soils			of adequate quality are important to reduce nitrate emissions. Drainage has the function of draining excess water. Also, changes in soil air-water relationships also affect the activity of beneficial microorganisms.							
Introduction of new cultivars, varieties and cultures	Agriculture	CO <sub>2</sub>	Determining the potential of new cultivars, varieties and cultures to increase carbon sequestration in soil	Information, Education	Planned	Decrease in the application of mineral nitrogen through the application of new cultivars with increased resistance and reduced need for nutrients, as well as specific legumes that have the ability of symbiotic relationship with nodule bacteria.	2020	Ministry of Agriculture					
Changing the way people eat	Agriculture	CO <sub>2</sub> , CH <sub>4</sub>	Gathering data on the potential for reducing greenhouse gas emissions from changes in diet	Information	Planned	The cultivation of livestock cereals produces much more greenhouse gas than the production of cereals for human consumption. By reducing the consumption of meat (especially red) in the diet for the benefit of plant-based foods, significant emissions reductions can be achieved as well as water savings.	2020	Ministry of Environment and Energy					
Collection and processing of agricultural plantations and residues for energy use	Agriculture	CO <sub>2</sub>	Optimization of cropped biomass collection of permanent crops/Optimization of harvesting biomass/Production of safely available biomass/Poor quality soil activation in the Republic of Croatia/Provision of low carbon energy during the process of production of heat and/or electricity (increase in RES share, reduction of CO <sub>2</sub> emissions)	Other (Environmental), Economic	Planned	Energy exploitation of post-harvest residues (with emphasis on crop production) is one of the most significant ways of producing biomass energy in the Republic of Croatia. Other possible sources are the remnants of the winter harvest of almost all horticultural species, as well as fast-growing energy crops that are planted/sown solely for the production of biomass for its conversion to energy. In order to develop the biomass market, biomass collection and logistics centers will be established	2020	Agricultural Companies, Pellet and Briquette Manufacturing Companies, Agricultural Holdings, Agricultural Cooperatives and Clusters					

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						using existing infrastructure (utilities, competence centers, business zones) to reduce the unit cost of producing biomass products and capitalize on the innovation capacity and necessary equipment for innovative biomass products for bioeconomics. The collection and logistics centers will act as a link between the biomass farmer, the processing of biomass into new value-added products, the development of new products and the marketing of these new products.							
Preventing the generation and reducing the amount of solid waste*	Waste management/waste	CO <sub>2</sub> , CH <sub>4</sub>	Reduction of waste for disposal/Increasing the amount of separately collected and recycled waste/Reduction of the amount of biodegradable waste disposed of/Reduction of greenhouse gas emissions/Educational and information activities on sustainable waste management/Economic viability	Regulatory, Other (Environmental), Economic, Education	Implemented	It is the first in the order of priority in the waste management, pursuant to the Sustainable Waste Management Act (OG 94/13, 73/17, 14/19). The projections include municipal solid waste, industrial waste and sludge from wastewater treatment plants. This measure is achieved by cleaner production, education, economic instruments and enforcement of regulations in waste management, and by investing in modern technologies. According to the Act, quantitative targets and deadlines for reducing the total amount of waste disposed to non-compliant landfills are defined. Disposal of waste to non-compliant landfills in Croatia is prohibited after 31 December 2017. According to Directive (EU) 2018/850 of the European Parliament and of	2013	Competent government bodies/Local and regional self-government units					



Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste, Member States should take the necessary measures to ensure that by 2035 the amount of municipal waste landfilled is reduced to 10% or less of the total amount of municipal waste generated (by weight). Croatia was given the possibility of a delay of five years to meet the target because it is among the Member States that are in 2013 landfilled more than 60% of its municipal waste. The five-year delay is included in the projections. In this case, Croatia must take the necessary measures by 2035 to reduce the amount of municipal waste landfilled to 25% or less of the total amount of municipal waste generated (by weight).							
Increasing the amount of separately collected and recycled solid waste*	Waste management/waste	CO <sub>2</sub> , CH <sub>4</sub>	Reduction of waste for disposal/Increasing the amount of separately collected and recycled waste/Reduction of the amount of biodegradable waste disposed of/Reduction of greenhouse gas emissions/Educational and information activities on sustainable waste management/Economic viability	Regulatory, Other (Environmental), Economic, Education	Implemented	It is the first in the order of priority in the waste management, pursuant to the Sustainable Waste Management Act (OG 94/13, 73/17, 14/19). The projections include municipal solid waste, industrial waste and sludge from wastewater treatment plants. This measure is achieved by cleaner production, education, economic instruments and enforcement of regulations in waste management, and by investing in modern technologies. According to the Act, quantitative targets and deadlines for reducing the total amount of waste	2013	Competent government bodies/Local and regional self-government units					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						disposed to non-compliant landfills are defined. Disposal of waste to non-compliant landfills in Croatia is prohibited after 31 December 2017. According to Directive (EU) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste, Member States should take the necessary measures to ensure that by 2035 the amount of municipal waste landfilled is reduced to 10% or less of the total amount of municipal waste generated (by weight). Croatia was given the possibility of a delay of five years to meet the target because it is among the Member States that are in 2013 landfilled more than 60% of its municipal waste. The five-year delay is included in the projections. In this case, Croatia must take the necessary measures by 2035 to reduce the amount of municipal waste landfilled to 25% or less of the total amount of municipal waste generated (by weight).							
Providing a system for the treatment and use of landfill gas*	Waste management/waste	CO <sub>2</sub> , CH <sub>4</sub>	Reduction of waste for disposal/Increasing the amount of separately collected and recycled waste/Reduction of the amount of biodegradable waste disposed of/Reduction of greenhouse gas emissions/Educational and information activities on sustainable waste	Regulatory, Other (Environmental), Economic, Education	Implemented	It is the first in the order of priority in the waste management, pursuant to the Sustainable Waste Management Act (OG 94/13, 73/17, 14/19). The projections include municipal solid waste, industrial waste and sludge from wastewater treatment plants. This measure is achieved by cleaner production.	2013	Competent government bodies/Local and regional self-government units					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
			management/Economic viability			education, economic instruments and enforcement of regulations in waste management, and by investing in modern technologies. According to the Act, quantitative targets and deadlines for reducing the total amount of waste disposed to non-compliant landfills are defined. Disposal of waste to non-compliant landfills in Croatia is prohibited after 31 December 2017. According to Directive (EU) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste, Member States should take the necessary measures to ensure that by 2035 the amount of municipal waste landfilled is reduced to 10% or less of the total amount of municipal waste generated (by weight). Croatia was given the possibility of a delay of five years to meet the target because it is among the Member States that are in 2013 landfilled more than 60% of its municipal waste. The five-year delay is included in the projections. In this case, Croatia must take the necessary measures by 2035 to reduce the amount of municipal waste landfilled to 25% or less of the total amount of municipal waste generated (by weight).							
Reducing the amount of disposed biodegradable waste*	Waste management/waste	CO <sub>2</sub> , CH <sub>4</sub>	Reduction of waste for disposal/Increasing the amount of separately collected and recycled	Regulatory, Other (Environmental),	Implemented	It is the first in the order of priority in the waste management, pursuant to the Sustainable Waste	2013	Competent government bodies/Local and					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
			waste/Reduction of the amount of biodegradable waste disposed of/Reduction of greenhouse gas emissions/Educational and information activities on sustainable waste management/Economic viability	Economic, Education		Management Act (OG 94/13, 73/17, 14/19). The projections include municipal solid waste, industrial waste and sludge from wastewater treatment plants. This measure is achieved by cleaner production, education, economic instruments and enforcement of regulations in waste management, and by investing in modern technologies. According to the Act, quantitative targets and deadlines for reducing the total amount of waste disposed to non-compliant landfills are defined. Disposal of waste to non-compliant landfills in Croatia is prohibited after 31 December 2017. According to Directive (EU) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste, Member States should take the necessary measures to ensure that by 2035 the amount of municipal waste landfilled is reduced to 10% or less of the total amount of municipal waste generated (by weight). Croatia was given the possibility of a delay of five years to meet the target because it is among the Member States that are in 2013 landfilled more than 60% of its municipal waste. The five-year delay is included in the projections. In this case, Croatia must take the necessary measures by 2035 to reduce the amount		regional self-government units					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						of municipal waste landfilled to 25% or less of the total amount of municipal waste generated (by weight).							
Use of biogas for biomethane production and electricity and heat generation*	Waste management/waste	CO <sub>2</sub> , CH <sub>4</sub>	Increasing the share of renewable energy sources in electricity and heat production/Increasing the share of renewable energy sources in transport/Reduction of GHG emissions/Economic viability	Regulatory, Other (Environmental), Economic	Implemented	The measure is related to the OIE-3 measure: Encouraging the use of RES for electricity and heat production, within the framework of renewable energy sources and measures from the Transport sector related to the use of renewable energy sources in transport. Looking at the waste management sector, the greenhouse gas reduction potential of this measure represents the potential for reducing methane emissions (produced by anaerobic digestion of the biodegradable fraction of waste), which is used to generate electricity and heat. Biomethane injection into the gas network is also envisaged.	2013	Competent government bodies/Local and regional self-government units					
Development of the Land Management Strategy of the Republic of Croatia	Forestry/LULUCF	CO <sub>2</sub>	Increase of CO <sub>2</sub> removal from LULUCF sector/Reduction of GHG emissions from the LULUCF sector/Aligning EU targets for increasing the share of renewable energy with emission reduction requirements	Economic, Information, Regulatory	Planned	By 2027, it is necessary to develop a Land Management Strategy of the Republic of Croatia. For the development of the same, it is necessary to implement projects that: 1. Establish a unique land information system in the Republic of Croatia or determine the areas of each LULUCF land category by using spatially determined data, for each land category and for each type of land conversion from one land category to another 2. Conducts analysis of all LULUCF land categories depending on cover, land	2020	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						use and management practices used on each land and associated emissions/removals to consider the potential of each of the storage sites within each LULUCF land category to reduce emissions and increase greenhouse gas outflows 3. Make detailed projections for the development of future emissions/removals in the LULUCF sector after carrying out the above analysis The calculation of emissions/removals in the LULUCF sector and these projects should form the basis for planning the cover, use and management of LULUCF land categories for each of the storage sites in order to develop a Land Management Strategy and to properly define the measures to be implemented in each land category which will reduce emissions and increase greenhouse gas outflows in the Republic of Croatia. Improving and defining forest fire protection measures should be an integral part of this strategy.							
Carbon accumulation on areas of existing forests	Forestry/LULUCF	CO <sub>2</sub>	Considering implementing forest management activities so that they contribute to increasing carbon dioxide removal/Ensuring the maintenance of a defined reference level for forests in the first and second binding periods under	Economic	Planned	Carrying out activities that contribute to increasing the carbon footprint of forests, in particular in the biomass storage facility and ensuring that removals in a given period exceed those defined by the Forest Reference Level (FRL). These activities are, for example, reforestation,	2020	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
			Regulation 841/2018 / EU (2021-2030)			conversion of stands to a higher cultivation form, selection of species for replenishment, etc. Maintaining a removal larger than that defined by the FRL also ensures an increase in emission units that can be transferred to sectors outside the ETS. Maintaining a removal greater than that defined by the FRL also ensures the use of flexible mechanisms. Further assessment of the effectiveness of the implemented measures and activities from the Rural Development Program to reduce/contain emissions and increase/contain greenhouse gas removals and develop new guidelines for further management in the forestry and agricultural sector with the application of measures to mitigate and adapt to climate change. It is necessary to promote the management of land categories that are beneficial to the climate and the environment, and to develop further development guidelines based on the knowledge and experience gained from the implementation of this measure.							
Reforestation works	Forestry/LULUCF	CO <sub>2</sub>	Further increase in carbon dioxide removal from the forestry sector/Increase of biomass available in the total share of renewable energy in the Republic of Croatia/Contribution to the EU target of a minimum of 32.5% share of renewable energy in total energy consumption by 2030	Economic	Planned	Afforestation on non-forested areas (in terms of IPCC methodology) is an activity that generates removals. Due to the regulations in the field of nature protection governing the establishment of Natura 2000 sites, the Republic of Croatia is not able to dispose of all lawn areas (according to the national	2020	Ministry of Environment and Energy					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						regulation: non-overgrown production forest land) for afforestation purposes. Considering that there are non-cultivated agricultural areas in the Republic of Croatia that have been neglected for many years, the problem of these areas must be adequately addressed when developing the Land Management Strategy. It is necessary to evaluate the justification for the conversion of these areas to forest areas by the implementation of afforestation. It should be borne in mind that there is no restriction on the application of the amount of removal when calculating removals due to reforestation, and that these removals are fully taken into account in the calculation. An assessment of the effects of afforestation of additional non-overgrown, productive forest land on the fulfillment of Croatia's obligations related to the use of renewable energy sources is also needed. Guidelines for further development based on the knowledge and experience gained from the implementation of afforestation activities need to be developed. In case of introduction of afforestation measure on neglected agricultural land, the measure will require strengthening of seed production and nursery services in the forestry sector and cultivation of planting material necessary							



Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						for the implementation of these works.							
Manufacture and use of wood and wood products	Forestry/LULUCF	CO <sub>2</sub>	Additional increase in carbon dioxide removal in the wood products tank (HWP)/Increasing the quality and harmonization of information on manufactured timber products for the purposes of meeting international obligations (UN, FAO, EU) and developing bases for the adoption of medium and long-term plans and strategies in the forestry and wood processing sector	Economic, Regulatory, Education, Information	Planned	Harmonizing the available data and statistical reports and conducting new research to agree on the information available for the purposes of different reporting to international organizations in order to provide accurate, transparent and high quality reporting, as well as to create harmonized bases for the adoption of medium and long-term strategies in the forestry and wood processing sector. It implies mapping of forestry and timber industrial production. Encourage the use of wood products in traditional and new products in order to increase removals and reduce greenhouse gas emissions in the wood storage facility. This also requires the regulation of exports of untreated and semi-treated timber, which encourages the development of the domestic timber industry, and the regulation of energy timber exports increases the share of energy production from renewable sources, thus fulfilling international commitments. Outflow-generating activities must be promoted to ensure that timber products and timber are used for energy purposes in ways that contribute to meeting both EU targets by 2030 (reducing emissions and increasing the share of renewables in total energy consumption) and are	2020	Ministry of Environment and Energy, Ministry of Agriculture					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						beneficial to climate and environment. Guidelines for further development should be drawn up based on the knowledge and experience gained from the implementation of this measure.							
Agricultural land management	Forestry/LULUCF	CO <sub>2</sub>	Reduce GHG emissions by changing and improving the management of agricultural land/Primarily related to the management of land under different types of crops or plantations	Economic	Planned	Conducting activities in the management of agricultural land in a way that contributes to reducing the emission factor is of interest to family farms, since the CAP regulations of EC regulations increase the level of incentives if the emission factor is lower due to the way they are managed. Land management practices that can affect emissions and removals, for example in soil storage, are: soil treatment methods, crop/crop life (rotation period) and crop/plantation type, fertilizer application, residue management, erosion control, application of irrigation systems. It is necessary to promote activities in a climate and environmentally beneficial manner, and to develop further development guidelines based on the knowledge and experience gained from the implementation of this measure.	2020	Ministry of Environment and Energy, Ministry of Agriculture					
Grassland management	Forestry/LULUCF	CO <sub>2</sub>	Reduce GHG emissions by changing and improving the management of pasture land in the Republic of Croatia	Economic	Planned	Conducting pasture management activities in a way that contributes to the reduction of the emission factor is of interest to family farms, since the CAP regulations of the EC regulations increase the level of incentives if the	2020	Ministry of Environment and Energy, Ministry of Agriculture					

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Brief description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
						emission factor is lower due to the management of these areas. Activities in a climate and environmentally beneficial manner should be promoted, and further development guidelines drawn up based on the knowledge and experience gained from the implementation of this measure.							
Implementation of technical projects and scientific research in the LULUCF sector	Forestry/LULUCF	CO <sub>2</sub>	Increase of CO <sub>2</sub> removal from LULUCF sector	Economic	Planned	In the period up to 2030 and 2050, it is necessary to provide funding for the implementation of technical and scientific projects in the LULUCF sector. Scientific projects should enable the development of different models for the purposes of moving to a higher level of IPCC methodology (Tier 3) with the aim of determining as accurately as possible GHG emissions/outflows and, consequently, planning measures to reduce emissions and increase outflows.	2020	Ministry of Environment and Energy, Ministry of Agriculture					
Combined estimate of the mitigation impact (Energy)*	Energy	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub>							0.00	346.01	675.95	1,000.66	1,287.26
Combined estimate of the mitigation impact (Transport)*	Transport	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub>							0.00	239.61	482.66	415.83	426.38
Combined estimate of the mitigation impact (Industry/industrial processes)*	Industry/industrial processes	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub>							187.63	162.88	154.62	238.86	322.70

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implement.	Breaif description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO <sub>2</sub> -eq				
									2020	2025	2030	2035	2040
Combined estimate of the mitigation impact (Agriculture)*	Agriculture	CO2, CH4, N2O, HFCs, PFCs, SF6							72.56	118.50	161.73	199.83	236.53

CTF Table 4: Reporting on progress

Table 4

HRV\_BR4\_v0.1

**Reporting on progress<sup>a, b</sup>**

	<i>Total emissions excluding LULUCF</i>	<i>Contribution from LULUCF<sup>d</sup></i>	<i>Quantity of units from market based mechanisms under the Convention</i>		<i>Quantity of units from other market based mechanisms</i>	
<i>Year<sup>c</sup></i>	<i>(kt CO<sub>2</sub> eq)</i>	<i>(kt CO<sub>2</sub> eq)</i>	<i>(number of units)</i>	<i>(kt CO<sub>2</sub> eq)</i>	<i>(number of units)</i>	<i>(kt CO<sub>2</sub> eq)</i>
Base year/period (1990)	31,858.36*					
2010	28,084.72*					
2011	27,788.93*					
2012	25,915.74*					
2013	24,554.54*					
2014	23,762.73*					
2015	24,247.42*					
2016	24,384.83*					
2017	25,019.75*					

## CTF Table 4(a)I\_2017: Progress towards achieving a quantified economy-wide target - further information on mitigation activities relevant to the LULUCF sector in 2017

Table 4(a)I

HRV\_BR4\_v0.1

**Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2017<sup>a,b</sup>**

	<i>Net GHG emissions/removals from LULUCF categories<sup>c</sup></i>	<i>Base year/period or reference level value<sup>d</sup></i>	<i>Contribution from LULUCF for reported year</i>	<i>Cumulative contribution from LULUCF<sup>e</sup></i>	<i>Accounting approach<sup>f</sup></i>
	<i>(kt CO<sub>2</sub> eq)</i>				
Total LULUCF					
A. Forest land					
1. Forest land remaining forest land					
2. Land converted to forest land					
3. Other <sup>g</sup>					
B. Cropland					
1. Cropland remaining cropland					
2. Land converted to cropland					
3. Other <sup>g</sup>					
C. Grassland					
1. Grassland remaining grassland					
2. Land converted to grassland					
3. Other <sup>g</sup>					
D. Wetlands					
1. Wetland remaining wetland					
2. Land converted to wetland					
3. Other <sup>g</sup>					
E. Settlements					
1. Settlements remaining settlements					
2. Land converted to settlements					
3. Other <sup>g</sup>					
F. Other land					
1. Other land remaining other land					
2. Land converted to other land					
3. Other <sup>g</sup>					
G. Other					
Harvested wood products					

## CTF Table 4(a)I\_2018: Progress towards achieving a quantified economy-wide target - further information on mitigation activities relevant to the LULUCF sector in 2018

Table 4(a)I

HRV\_BR4\_v0.1

**Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2018<sup>a, b</sup>**

	<i>Net GHG emissions/removals from LULUCF categories<sup>c</sup></i>	<i>Base year/period or reference level value<sup>d</sup></i>	<i>Contribution from LULUCF for reported year</i>	<i>Cumulative contribution from LULUCF<sup>e</sup></i>	<i>Accounting approach<sup>f</sup></i>
	<i>(kt CO<sub>2</sub> eq)</i>				
Total LULUCF					
A. Forest land					
1. Forest land remaining forest land					
2. Land converted to forest land					
3. Other <sup>g</sup>					
B. Cropland					
1. Cropland remaining cropland					
2. Land converted to cropland					
3. Other <sup>g</sup>					
C. Grassland					
1. Grassland remaining grassland					
2. Land converted to grassland					
3. Other <sup>g</sup>					
D. Wetlands					
1. Wetland remaining wetland					
2. Land converted to wetland					
3. Other <sup>g</sup>					
E. Settlements					
1. Settlements remaining settlements					
2. Land converted to settlements					
3. Other <sup>g</sup>					
F. Other land					
1. Other land remaining other land					
2. Land converted to other land					
3. Other <sup>g</sup>					
G. Other					
Harvested wood products					

## CTF Table 4(a)I\_2018: Progress towards achieving a quantified economy-wide target - further information on mitigation activities relevant to the LULUCF sector in 2018, cont.

Table 4(a)II

HRV\_BR4\_v0.1

Source: Submission 2020 v2, CROATIA

Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under

Article 3, paragraphs 3 and 4, of the Kyoto Protocol<sup>a,b,c</sup>

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	Base year <sup>d</sup>	Net emissions/removals <sup>e</sup>									Accounting parameters <sup>h</sup>	Accounting quantity <sup>i</sup>
		2013	2014	2015	2016	2017	2018	2019	2020	Total <sup>g</sup>		
	(kt CO <sub>2</sub> eq)											
A. Article 3.3 activities												
A.1. Afforestation/reforestation		-88.52	-97.35	-136.05	-235.24	-186.69				-743.86	-743.86	
Excluded emissions from natural disturbances(5)		NO	NO	NO	NO	NO				NO	NO	
Excluded subsequent removals from land subject to natural disturbances(6)		NA	NA	NA	NA	NA				NA	NA	
A.2. Deforestation		44.84	23.67	58.59	23.72	17.70				168.51	168.51	
B. Article 3.4 activities												
B.1. Forest management												
Net emissions/removalse		-7,070.99	-6,967.67	-6,310.85	-6,288.76	-5,536.30				-32,174.58	-5253.73	
Excluded emissions from natural disturbances(5)		NO	NO	NO	NO	NO				NO	NO	
Excluded subsequent removals from land subject to natural disturbances(6)		NA	NA	NA	NA	NA				NA	NA	
Any debits from newly established forest (CEF-ne)(7),(8)		NA	NA	NA	NA	NA				NA	NA	
Forest management reference level (FMRL)(9)										-6289.00		
Technical corrections to FMRL(10)										904.83		
Forest management capl										8770.10	-5253.73	
B.2. Cropland management (if elected)	NA	NA	NA	NA	NA	NA				NA	NA	
B.3. Grazing land management (if elected)	NA	NA	NA	NA	NA	NA				NA	NA	
B.4. Revegetation (if elected)	NA	NA	NA	NA	NA	NA				NA	NA	
B.5. Wetland drainage and rewetting (if elected)	NA	NA	NA	NA	NA	NA				NA	NA	



## CTF Table 4(b) Report on progress

Table 4(b)

HRV\_BR4\_v0.1

**Reporting on progress<sup>a, b, c</sup>**

<i>Units of market based mechanisms</i>			<i>Year</i>	
			<i>2017</i>	<i>2018</i>
<i>Kyoto Protocol units<sup>d</sup></i>	<i>Kyoto Protocol units</i>	<i>(number of units)</i>		
		<i>(kt CO<sub>2</sub> eq)</i>		
	<i>AAUs</i>	<i>(number of units)</i>		
		<i>(kt CO<sub>2</sub> eq)</i>		
	<i>ERUs</i>	<i>(number of units)</i>		
		<i>(kt CO<sub>2</sub> eq)</i>		
	<i>CERs</i>	<i>(number of units)</i>		
		<i>(kt CO<sub>2</sub> eq)</i>		
	<i>tCERs</i>	<i>(number of units)</i>		
		<i>(kt CO<sub>2</sub> eq)</i>		
<i>Other units<sup>d,e</sup></i>	<i>Units from market-based mechanisms under the Convention</i>	<i>(number of units)</i>		
		<i>(kt CO<sub>2</sub> eq)</i>		
	<i>Units from other market-based mechanisms</i>	<i>(number of units)</i>		
		<i>(kt CO<sub>2</sub> eq)</i>		
<i>Total</i>		<i>(number of units)</i>		
		<i>(kt CO<sub>2</sub> eq)</i>		

CTF Table 5 Summary of key variables and assumptions used in the projections analysis

Table 5

HRV\_BR4\_v0.1

**Summary of key variables and assumptions used in the projections analysis<sup>a</sup>**

<i>Key underlying assumptions</i>		<i>Historical<sup>b</sup></i>							Projected				
<i>Assumption</i>	<i>Unit</i>	<i>1990</i>	<i>1995</i>	<i>2000</i>	<i>2005</i>	<i>2010</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>2018</i>	<i>2020</i>	<i>2025</i>	<i>2030</i>
<i>GDP growth rate</i>	%		13.11	3.75	4.11	-1.47	2.40	1.57	1.85	2.13	2.70	2.20	2.20
Population	thousands	4,778.00	4,494.00	4,426.00	4,442.00	4,418.00	4,151.92	4,098.71	4,069.95	4,041.20	3,983.70	3,833.53	3,755.42
Number of households	thousands	1,494.72	1,311.50	1,417.04	1,451.14	1,488.89	1,467.83	1,463.62	1,465.73	1,467.84	1,472.05	1,480.97	1,519.91
International oil price	USD / boe			38.00		86.00		41.00				83.00	94.00
EU gas price	USD / Mbtu			3.80		8.20		4.90				7.90	8.60
EU coal price	USD / tonne			46.00		101.00		63.00				77.00	80.00
Electricity price	EUR / MWh						41.00				40.60	47.30	60.00
<i>Emission unit price</i>	<i>EUR / tCO<sub>2e</sub></i>						7.70				25.60	29.90	34.30

CTF Table 6(a) Information on updated greenhouse gas projections under a 'with measures' scenario

Table 6(a)

HRV\_BR4\_v0.1

**Information on updated greenhouse gas projections under a 'with measures' scenario<sup>a</sup>**

	GHG emissions and removals <sup>b</sup>								GHG emission projections	
	(kt CO <sub>2</sub> eq)								(kt CO <sub>2</sub> eq)	
	Base year (1990)	1990	1995	2000	2005	2010	2015	2017	2020	2030
<b>Sector<sup>d,e</sup></b>										
Energy	12,319.58	12,319.58	9,697.94	10,635.92	12,295.19	10,764.71	8,420.12	8,286.13	7,125.49	7,355.01
Transport	3,881.11	3,881.11	3,367.95	4,499.39	5,561.59	5,952.34	5,951.83	6,645.14	6,241.73	6,358.30
Industry/industrial processes	10,206.59	10,206.59	5,436.65	6,252.64	7,313.05	6,362.48	5,032.16	5,149.47	5,133.43	4,911.20
Agriculture	4,399.65	4,399.65	3,265.24	3,133.54	3,324.11	3,094.31	2,879.62	2,844.64	2,702.81	2,605.40
Forestry/LULUCF	-6,654.58	-6,654.58	-9,063.17	-6,966.66	-7,767.06	-7,116.31	-5,434.54	-4,766.58	-4,257.27	-2,487.82
Waste management/waste	1,051.44	1,051.44	1,168.98	1,339.39	1,518.40	1,910.88	1,963.69	2,094.36	2,151.10	1,419.58
Other (specify)										
<b>Gas</b>										
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	16,648.52	16,648.52	7,824.44	12,533.66	15,540.05	13,864.78	12,301.70	13,751.31	12,796.97	14,891.38
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	23,337.10	23,337.10	16,933.29	19,699.20	23,383.84	21,064.49	17,840.71	18,716.77	17,166.74	17,494.47
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	4,425.06	4,425.06	3,670.03	3,620.54	3,889.29	4,193.24	4,116.62	4,177.49	4,043.31	3,328.09
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	4,423.83	4,423.83	3,662.49	3,523.63	3,886.56	4,191.48	4,102.65	4,108.25	4,026.01	3,310.79
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	2,879.51	2,879.51	2,338.67	2,580.50	2,537.11	2,522.53	1,906.85	1,829.27	1,739.50	1,763.69
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	2,846.74	2,846.74	2,300.53	2,478.52	2,463.11	2,440.89	1,816.34	1,699.63	1,644.30	1,665.74
HFCs	NO	NO	29.32	147.90	265.80	378.87	482.50	488.71	510.85	170.28
PFCs	1,240.24	1,240.24	NO	NO	NO	0.03	NO	NO	NO	NO
SF <sub>6</sub>	10.45	10.45	11.12	11.62	13.03	8.95	5.22	6.39	6.66	8.21
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other (specify)										
<b>Total with LULUCF<sup>f</sup></b>	25,203.78	25,203.78	13,873.58	18,894.22	22,245.28	20,968.40	18,812.89	20,253.17	19,097.29	20,161.65
<b>Total without LULUCF</b>	31,858.36	31,858.36	22,936.75	25,860.87	30,012.34	28,084.71	24,247.42	25,019.75	23,354.56	22,649.49

CTF Table 6(c) Information on updated greenhouse gas projections under a 'with additional measures' scenario

Table 6(c)

HRV\_BR4\_v0.1

**Information on updated greenhouse gas projections under a 'with additional measures' scenario<sup>a</sup>**

	GHG emissions and removals <sup>b</sup>								GHG emission projections	
	(kt CO <sub>2</sub> eq)								(kt CO <sub>2</sub> eq)	
	Base year (1990)	1990	1995	2000	2005	2010	2015	2017	2020	2030
<b>Sector<sup>d,e</sup></b>										
Energy	12,319.58	12,319.58	9,697.94	10,635.92	12,295.19	10,764.71	8,420.12	8,286.13	7,125.49	6,449.57
Transport	3,881.11	3,881.11	3,367.95	4,499.39	5,561.59	5,952.34	5,951.83	6,645.14	6,241.73	5,587.68
Industry/industrial processes	10,206.59	10,206.59	5,436.65	6,252.64	7,313.05	6,362.48	5,032.16	5,149.47	4,866.42	4,334.77
Agriculture	4,399.65	4,399.65	3,265.24	3,133.54	3,324.11	3,094.31	2,879.62	2,844.64	2,630.25	2,362.70
Forestry/LULUCF	-6,654.58	-6,654.58	-9,063.17	-6,966.66	-7,767.06	-7,116.31	-5,434.54	-4,766.58	NA	NA
Waste management/waste	1,051.44	1,051.44	1,168.98	1,339.39	1,518.40	1,910.88	1,963.69	2,094.36	2,151.10	1,419.58
Other (specify)										
<b>Gas</b>										
CO <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	16,648.52	16,648.52	7,824.44	12,533.66	15,540.05	13,864.78	12,301.70	13,751.31	NA	NA
CO <sub>2</sub> emissions excluding net CO <sub>2</sub> from LULUCF	23,337.10	23,337.10	16,933.29	19,699.20	23,383.84	21,064.49	17,840.71	18,716.77	16,899.73	15,374.30
CH <sub>4</sub> emissions including CH <sub>4</sub> from LULUCF	4,425.06	4,425.06	3,670.03	3,620.54	3,889.29	4,193.24	4,116.62	4,177.49	NA	NA
CH <sub>4</sub> emissions excluding CH <sub>4</sub> from LULUCF	4,423.83	4,423.83	3,662.49	3,523.63	3,886.56	4,191.48	4,102.65	4,108.25	3,955.18	3,008.49
N <sub>2</sub> O emissions including N <sub>2</sub> O from LULUCF	2,879.51	2,879.51	2,338.67	2,580.50	2,537.11	2,522.53	1,906.85	1,829.27	NA	NA
N <sub>2</sub> O emissions excluding N <sub>2</sub> O from LULUCF	2,846.74	2,846.74	2,300.53	2,478.52	2,463.11	2,440.89	1,816.34	1,699.63	1,642.58	1,604.12
HFCs	NO	NO	29.32	147.90	265.80	378.87	482.50	488.71	510.85	159.17
PFCs	1,240.24	1,240.24	NO	NO	NO	0.03	NO	NO	NO	NO
SF <sub>6</sub>	10.45	10.45	11.12	11.62	13.03	8.95	5.22	6.39	6.66	8.21
NF <sub>3</sub>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other (specify)										
<b>Total with LULUCF<sup>f</sup></b>	25,203.78	25,203.78	13,873.58	18,894.22	22,245.28	20,968.40	18,812.89	20,253.17	517.51	167.38
<b>Total without LULUCF</b>	31,858.36	31,858.36	22,936.75	25,860.87	30,012.34	28,084.71	24,247.42	25,019.75	23,015.00	20,154.29

CTF Table 7: Provision of public financial support: summary information in 2017

Table 7

HRV\_BR4\_v0.1

**Provision of public financial support: summary information in 2017<sup>a</sup>**

Allocation channels	Year									
	European euro - EUR					USD <sup>b</sup>				
	Core/ general <sup>c</sup> <sub>1</sub>	Climate-specific <sup>d, 2</sup>				Core/ general <sup>c</sup> <sub>1</sub>	Climate-specific <sup>d, 2</sup>			
		Mitigation	Adaptation	Cross-cutting <sup>e</sup>	Other <sup>f</sup>		Mitigation	Adaptation	Cross-cutting <sup>e</sup>	Other <sup>f</sup>
<b>Total contributions through multilateral channels:</b>	20,439.00									
Multilateral climate change funds <sup>g</sup>										
Other multilateral climate change funds <sup>h</sup>										
Multilateral financial institutions, including regional development banks										
Specialized United Nations bodies	20,439.00									
<b>Total contributions through bilateral, regional and other channels</b>										
<b>Total</b>	20,439.00									

CTF Table 7: Provision of public financial support: summary information in 2018

Table 7

HRV\_BR4\_v0.1

**Provision of public financial support: summary information in 2018<sup>a</sup>**

Allocation channels	Year									
	European euro - EUR					USD <sup>b</sup>				
	Core/ general <sup>c</sup> <sub>1</sub>	Climate-specific <sup>d, 2</sup>				Core/ general <sup>c</sup> <sub>1</sub>	Climate-specific <sup>d, 2</sup>			
		Mitigation	Adaptation	Cross-cutting <sup>e</sup>	Other <sup>f</sup>		Mitigation	Adaptation	Cross-cutting <sup>e</sup>	Other <sup>f</sup>
<b>Total contributions through multilateral channels:</b>	28,292.00									
Multilateral climate change funds <sup>g</sup>										
Other multilateral climate change funds <sup>h</sup>										
Multilateral financial institutions, including regional development banks										
Specialized United Nations bodies	28,292.00									
<b>Total contributions through bilateral, regional and other channels</b>										
<b>Total</b>	28,292.00									

CTF Table 7 (a): Provision of public financial support: contribution through multilateral channels in 2017

Table 7(a)

HRV\_BR4\_v0.1

**Provision of public financial support: contribution through multilateral channels in 2017<sup>a</sup>**

Donor funding	Total amount				Status <sup>b, 3</sup>	Funding source <sup>f, 4</sup>	Financial instrument <sup>f, 5</sup>	Type of support <sup>f, 8, 6</sup>	Sector <sup>c, f, 7</sup>
	Core/general <sup>d, 1</sup>		Climate-specific <sup>e, 2</sup>						
	European euro - EUR	USD	European euro - EUR	USD					
Total contributions through multilateral channels	20,439.00								
Multilateral climate change funds									
1. Global Environment Facility									
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund									
5. Green Climate Fund									
6. UNFCCC Trust Fund for Supplementary Activities									
7. Other multilateral climate change funds									
Multilateral financial institutions, including regional development banks									
1. World Bank									
2. International Finance Corporation									
3. African Development Bank									
4. Asian Development Bank									
5. European Bank for Reconstruction and Development									
6. Inter-American Development Bank									
7. Other									
Specialized United Nations bodies	20,439.00								
1. United Nations Development Programme									
7. Other multilateral climate change funds									
2. United Nations Environment Programme	20,439.00								
7. Other multilateral climate change funds - Core budget for the UNFCCC and KP	20,439.00					Other (State budget)		Cross-cutting	
3. Other									

CTF Table 7 (a): Provision of public financial support: contribution through multilateral channels in 2018

Table 7(a)

HRV\_BR4\_v0.1

**Provision of public financial support: contribution through multilateral channels in 2018<sup>a</sup>**

Donor funding	Total amount				Status <sup>b, 3</sup>	Funding source <sup>f, 4</sup>	Financial instrument <sup>f, 5</sup>	Type of support <sup>f, 8, 6</sup>	Sector <sup>c, f, 7</sup>
	Core/general <sup>d, 1</sup>		Climate-specific <sup>e, 2</sup>						
	European euro - EUR	USD	European euro - EUR	USD					
Total contributions through multilateral channels	28,292.00								
Multilateral climate change funds									
1. Global Environment Facility									
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund									
5. Green Climate Fund									
6. UNFCCC Trust Fund for Supplementary Activities									
7. Other multilateral climate change funds									
Multilateral financial institutions, including regional development banks									
1. World Bank									
2. International Finance Corporation									
3. African Development Bank									
4. Asian Development Bank									
5. European Bank for Reconstruction and Development									
6. Inter-American Development Bank									
7. Other									
Specialized United Nations bodies	28,292.00								
1. United Nations Development Programme									
2. United Nations Environment Programme	28,292.00								
7. Other multilateral climate change funds - Core budget for the UNFCCC and KP	28,292.00					Other (State budget)			
3. Other									



CTF Table 7 (b): Provision of public financial support: contribution through bi-lateral, regional and other channels in 2017

Table 7(b)

HRV\_BR4\_v0.1

**Provision of public financial support: contribution through bilateral, regional and other channels in 2017<sup>a</sup>**

Recipient country/ region/project/programme <sup>b</sup>	Total amount		Status <sup>c, 3</sup>	Funding source <sup>g, 4</sup>	Financial instrument <sup>g, 5</sup>	Type of support <sup>g, h, 6</sup>	Sector <sup>d, g, 7</sup>	Additional information <sup>e</sup>
	Climate-specific <sup>f, 2</sup>							
	European euro - EUR	USD						
Total contributions through bilateral, regional and other channels								

CTF Table 7 (b): Provision of public financial support: contribution through bi-lateral, regional and other channels in 2018

Table 7(b)

HRV\_BR4\_v0.1

**Provision of public financial support: contribution through bilateral, regional and other channels in 2018<sup>a</sup>**

Recipient country/ region/project/programme <sup>b</sup>	Total amount		Status <sup>c, 3</sup>	Funding source <sup>g, 4</sup>	Financial instrument <sup>g, 5</sup>	Type of support <sup>g, h, 6</sup>	Sector <sup>d, g, 7</sup>	Additional information <sup>e</sup>
	Climate-specific <sup>f, 2</sup>							
	European euro - EUR	USD						
Total contributions through bilateral, regional and other channels								

CTF Table 8: Provision of technology development and transfer support

Table 8

HRV\_BR4\_v0.1

Provision of technology development and transfer support<sup>a,b</sup>

<i>Recipient country and/or region</i>	<i>Targeted area</i>	<i>Measures and activities related to technology transfer</i>	<i>Sector<sup>c</sup></i>	<i>Source of the funding for technology transfer</i>	<i>Activities undertaken by</i>	<i>Status</i>	<i>Additional information<sup>d</sup></i>

CTF Table 9: Provision of capacity-building support

Table 9

HRV\_BR4\_v0.1

Provision of capacity-building support<sup>a</sup>

<i>Recipient country/region</i>	<i>Targeted area</i>	<i>Programme or project title</i>	<i>Description of programme or project<sup>b,c</sup></i>