REPUBLIC OF CROATIA

MINISTRY OF ENVIRONMENTAL AND NATURE PROTECTION

SIXTH NATIONAL COMMUNICATION AND FIRST BIENNIAL REPORT OF THE REPUBLIC OF CROATIA UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

January 2014

CONTENT

1. EXECUTIVE SUMMARY

1.1. Introduction

The Republic of Croatia became a party to the Convention on 17 January 1996 when the Croatian Parliament passed the law on its ratification (OG, International Treaties 2/96). For the Republic of Croatia the Convention came into force on 7 July 1996. As a country undergoing the process of transition to market economy, Croatia has, pursuant to Article 22, paragraph 3 of the Convention, assumed 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 Protocol in April 2007 and entered into force on 28 August 2007. By ratifying the Protocol (OG, International Treaties 5/07), the Republic of Croatia, as the Protocol Annex B party, takes over the obligation of limiting the greenhouse gases emission in the period 2008-2012 to 95% of total emission in the base year, i.e. 1990.

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 instructions of the Conference of Parties.

By accessing to the European Union (hereinafter referred to as the EU) on 1 July 2013, the Republic of Croatia has, due to the obligations arising from the EU acquis communaitaire, implemented into its legal system obligations on reporting on implementation of policy and measures regarding the reduction of emissions and increase of greenhouse gases removal and long-term emission projections that will be periodically submitted to the EU authorities.

Since 2002 the Republic of Croatia has prepared five national communications, whereat the Second, Third and Fourth National Communication were integrated into one national communication, while the last one, the Fifth National Communication was submitted to the Convention Secretariat in February 2010.

This Sixth National Communication of the Republic of Croatia, as all the previous, was prepared according to Guidelines for the Preparation of National Communications by Parties included in Annex I to the Convention (FCCC/CP/1997/7, Part II). Annotated outline for Fifth National Communication prepared by the Convention Secretariat were applied as well, not having a status of the official obligation yet, but help countries to prepare their national communications more consistently, as required by the Convention and the Protocol.

This Sixth National Communication covers the four-year period from 2008 till 2011 although some information related to legal framework, policies and measures and research in the field of climate change are given for 2012 and 2013.

This Sixth National Communication contains the first Biennial Report of the Republic of Croatia according to Decision 2/CP.17 of the Convention and is presented in Annex III to this document.

1.2. National circumstances

Social-political structure

The Republic of Croatia became an independent state on 8 October 1991 by a decision of the Croatian Parliament. The Croatian Constitution was adopted on 22 December 1990. The Republic of Croatia is a member of the United Nations since 22 May 1992 and the European Union since 1 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, 4 state administration offices, 8 state bureaus and 20 county offices of government bodies. The Ministry of Environmental and Nature Protection is the central government authority in charge of administrative and expert environmental protection activities relating to the climate protection.

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. The area of the Republic of Croatia is not equally populated. In 2011, the average population density amounted 75.7 inhabitants/km^2 with range of 9.5 (Lika-Senj County) to 1,232.5 inhabitants/km^2 (City of Zagreb).

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^2. The inland area amounts 56,594 km^2, while the area of territorial sea and internal sea waters amounts 31,067 km^2. Total length of inland borders of the Republic of Croatia towards neighbouring countries amounts 2,374.9 km (including river borders). The length of sea coast amounts 6,278 km (29.9% of inland, 70.1% of islands). The state sea border is 948 km long and extended at outer boundary of territorial sea. The Ecological and Fisheries Protection Zone of 23,870 km^2 reaches epicontinental border between the Republic of Croatia and Italy. In 2011, used agricultural area occupied 23.4%, while forest area occupied 39.4% of the Republic of Croatia territory. A majority of protected area are nature parks (4.54% of total state territory).

Climate

According to Köppen classification for a standard period 1961-1990, the largest part of the Republic of Croatia belongs to the climate type C, a moderately warm rainy climate. The annual mean air temperature in the lowland area of northern Croatia is 10-12°C, at altitudes above 400 m it is under 10 °Clower and in the mountains it is 3-4°C. In the coastal area it is 12-17°C. The least precipitation in Croatia is recorded in the open part of the central Adriatic (Palagruža, 304 mm) and in the eastern Slavonia and Baranja (Osijek, 650 mm). Central Croatia and the coastal zone have annual precipitation between 800 and 1,200 mm. The amount of precipitation in the

Pannonian region decreases from the west towards the east. From the coast towards the inland the precipitation increases. Most of the precipitation is recorded on the coastal slopes and peaks of the Dinarides (Risnjak, 3,470 m), from Gorski Kotar in the northwest to the southern Velebit in the southeast. The coastal zone from Dugi otok to Prevlaka is the fairest part of the Republic of Croatia with the annual cloudiness of 4/10. The islands of the central and southern Adriatic (Hvar, Vis and Korčula) have 2,700 hours of sunshine per year. The majority of inland places in the Republic of Croatia have 1,800-2,000 hours of sunshine. The annual largest cloudiness is recorded in Gorski kotar (6-7/10), which has the least hours of sunshine yearly – about 1,700.

Economy

In 2011, the Croatian economy recorded a period of stagnation of real economic activity in relation to 2010, representing blocking of negative trends from the previous period. A majority of other macroeconomic indicators also recorded slightly favourable trends in relation to the previous period. In 2011, the gross domestic product (GDP) amounted 328,737 millions of HRK (44,220 millions of EUR), which amounts HRK 76,755 per capita (EUR 10,325 per capita).

Energy structure

Primary energy generation in 2011 was decreased by 18% from the previous year. Due to unfavorable hydrology, hydro power utilization decreased by as much as 46.6%. The production of natural gas, crude oil and heat generated by use of heat pumps also decreased. The natural gas production decreased by 9.4%, of crude oil by 7.6 % and of heat by 1.7 %. The production of fuel wood and biomass and of other renewables increased in 2011 by 34% in relation to 2010. Renewable energy sources include wind energy, solar energy, geothermal energy, biodiesel and biogas, which total generation in 2011 increased by 12.9% in relation to 2010. In 2011, total energy import in the Republic of Croatia decreased by 5.2% from the previous year, whereat the import of crude oil, natural gas and of coal and coke decreased, while the import of electricity, petroleum products and fuel wood and biomass increased. In relation to 2010, energy consumption in industry in 2011 was decreased by 6.6%. Energy consumption in transport was also decreased by 2.1%, as well as energy consumption in other sectors by 1.1%.

Transport

The total length of roads in 2011 was amounted to 29,410 km. Number of road vehicles in 2011 was amounted to 1,818,983, of which 81.4% were passenger cars, 6.9% of light duty vehicles, 2% heavy duty vehicles and buses and 9.7% of mopeds and motorcycles, which makes 336 passenger cars per 1,000 inhabitants. In the period 2008-2011 the total number of motor vehicles decreased by 4.6%. Most passengers are transported by road and railway transport, and the most goods by road and sea water and coastal transport. The length of railway lines has not changed since 2006 with a total of 2,722 km of which 2,468 km are single track and 254 km of double track railway. In 2011, a total of 984 km of railway lines were electrified, which amounts to 36% of the total railway length. The Republic of Croatia has six ports of international economic interest in the cities: Rijeka, Zadar, Šibenik, Split, Ploče and Dubrovnik. The network of inland waterways of the Republic of Croatian is 804 km, of which 539 km are international waterways. Inland ports open to international public transport are: Osijek, Sisak, Slavonski Brod and Vukovar. The Republic of Croatia has 7 international airports: Zagreb, Split, Dubrovnik, Zadar, Osijek, Rijeka and Pula and 3 national airports: Brač, Mali Lošinj and Osijek for aircraft in commercial air transport. Pipeline transport includes transport of oil and gas. The 2011 length of

the pipeline amounted to 610 km and has not changed since 2005. The length of the pipeline in 2011 was amounted to 2.410 km and is steadily increasing.

Industry

Until the recession, industrial production in the Republic of Croatia was covered a significant place in the overall production. Stood out the manufacturing and petrochemical industries and shipbuilding. Some companies were abolished in transition process and some were destroyed during war. Above mentioned, mainly refers to companies that manufacture textiles, leather, metal and wood products. The production in construction and energy sectors was also significant. Some industry still continues to generate positive results and participate in foreign trade. The sale value of industrial products in 2011 amounted to 129.8 billion HRK (17.4 billion euros), of which 49.1 billion HRK (6.6 billion euros) goes to export. According to the total income, the leading industries were production of food, beverages and tobacco products followed by the chemical and petroleum industries. In exports, the most common industry were manufacture of refined petroleum products (11.8 %), motor vehicles (11.2 %), chemical products (8.3 %), food products (8.1 %), electrical equipment (7.8 %), machinery (6.3 %), fabricated metal products (6.1%), pharmaceutical products (4.8 %), wearing apparel (2.9 %), and wood and products of wood (3.4%).

Waste management

Total municipal waste produced in 2011 amounted to 1,645,295.0 tonnes. All cities and municipalities had organized the collection and disposal of municipal waste, while the population covered by organized collection amounted to 96%. The annual amount of municipal waste per capita was 371 kg and the daily amount per capita of about 1.0 kg. The share of mixed municipal waste (key number 20 03 01) in collected waste accounted for 84%, or 1,377,242.0 tonnes. The share of separately collected types of waste from municipal waste was 16%, which is 2% higher in comparison to 2010. Of the total quantity of wastes collected separately from municipal waste, which amounted to 268,053.0 tonnes, only half is directly addressed to recovery. The share of separately collected biodegradable waste in total produced biodegradable waste was 9.3%, while the share of which was sent to the recovery was 6.2% .

House construction and housing

Construction of buildings in the Republic of Croatia had a negative trend in period from 2004 to 2011. The number of completed residential buildings were decreased by 39.7% during this period. Number of dwellings, however, has continued an upward trend until 2007, when it started the downward trend of 51.6%. The number of completed non-residential buildings were decreased by 42.6%. In the same period the number of completed hotels and similar buildings were most reduced non-residential buildings and were decreased by 65.1% following by wholesale and retail trade buildings by 55.7%.

Agriculture

In 2011, utilized agricultural area was 1,326,083 ha, which is 23.4% of the total land area of the Republic of Croatia. Since 2007 the Republic of Croatia has a positive trend in the use of agricultural land with increase of 10.3%. Most represented category in 2011 was the arable land and gardens with 67.3% and permanent grassland with 26.1%, while other categories of utilised

agricultural land together constitute 6.6%. Utilisation of arable land and gardens increased by 5.1% in the period from 2007 to 2011, and permanent grassland by 22.12%. Livestock number in 2011 compared to 2004, has declined. Total catches in 2011 was amounted to 77,759 tons, of which 85.7% is blue fish and remaining are the other fish, crustaceans and oysters, other molluscs and shellfish. Mariculture includes fish farms for white fish, blue fish and shellfish.

Forestry and terrestrial ecosystems

Pursuant to the Forest Management Plan in force, total forest and forest land area in the Republic of Croatia amounted 2,688,687 ha in 2006, which as regarding total inland area of the Republic of Croatia represents forest cover of 47.5%. Out of total forest area, productive forest land with tree cover amounts 2,402,782 ha (89.4%) and the rest is productive forest land without tree cover (productive, non-productive and unfertile land). In total forest area, 75% of forests is owned by the state, managed by the company Hrvatske šume Ltd., while the rest is privately owned. The Forest Management Plan in force determines growing stock of about 398 millions of m^3 while its yearly increment amounts about 10.5 millions of m^3. Species' abundance in the total growing stock is as follows: Common beech 36%, Pedunculate oak 13%, Sessile oak 10%, Common hornbeam 9%, Silver fir 9%, Narrow-leafed ash 3%, Spruce 2%, Black alder 2%, Black locust 1%, Turkey oak 1% and other 14%.

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, Prokljan Lake, Visovac Lake and Vrana Lake on the island of Cres.

The Republic of Croatia is also characterized by significant wetland areas. Five locations have been included in the Ramsar list: Kopački rit in the Drava and Danube cathments, 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).

According to the average water balance, the Republic of Croatia abounds with water but the interannual distribution of water quantities is not favourable due to the significant spatial and time unequality in water resources distribution.

1.3. Trends in greenhouse gas emissions

In this report the results of the greenhouse gas (GHG) emissions and removals calculation are presented for the period from 1990 to 2011.[1] Inventory involves calculation of emissions which are the result of anthropogenic activities and these include the following GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated carbons (HFCs, PFCs) and sulphur hexafluoride (SF_6) and indirect GHGs: carbon monoxide (CO), oxides of nitrogen (NO_x), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2). The GHGs covered by Montreal Protocol on the pollutants related to ozone depletion (freons) are reported in the framework of this protocol and therefore are included in a separate report.

The total GHG emissions in 2011, excluding removals by sinks, amounted to 28,421 Gg CO_2-eq, which represents 10.3 percent emission reduction compared to GHG emission in the year 1990.

Overall decline of economic activities and energy consumption in the period 1991-1994, which was mainly the consequence of the war in Croatia, had directly caused the decline in total emissions of GHGs in that period. Some energy intensive industries reduced their activities or phased out certain productions, which was considerably reflected in GHG emissions reduction. Emissions have started to increase in the 1995 at an average rate of 3 percent per year, till 2008. Due to decreasing of economic activity within the period 2009-2011, emission has been reduced by 6.4 percent in 2009, 8.0 percent in 2010 and 9.3 percent in 2011, regarding 2008.

The main reasons of GHG emission increase in the period 1995-2008 were in Energy sector (sub-sectors Public electricity and heat production and Transport), Industrial processes (sub-sectors Cement production, Lime production, Ammonia production, Nitric acid production and Consumption of HFCs) and Waste sector (sub-sectors Solid waste disposal on land and Waste water handling).

The main reason of GHG emission decrease in the period 2009-2011 was economic crisis. Namely, because of the economic crisis, there was decrease in industrial production and consequently, decrease in fuel consumption (greatest reduction in fuel consumption was in Manufacturing industries and construction sector and also in Transport sector), as well as a reduction in cement, lime and steel productions, which was contributed to the GHG emission decrease.

The trend of aggregated emissions, divided by gasses, is shown in Figure 1.3-1.

[1] National Inventory Report 2013, Croatian greenhouse gas inventory for the period 1990-2011 (hereinafter: NIR 2013).

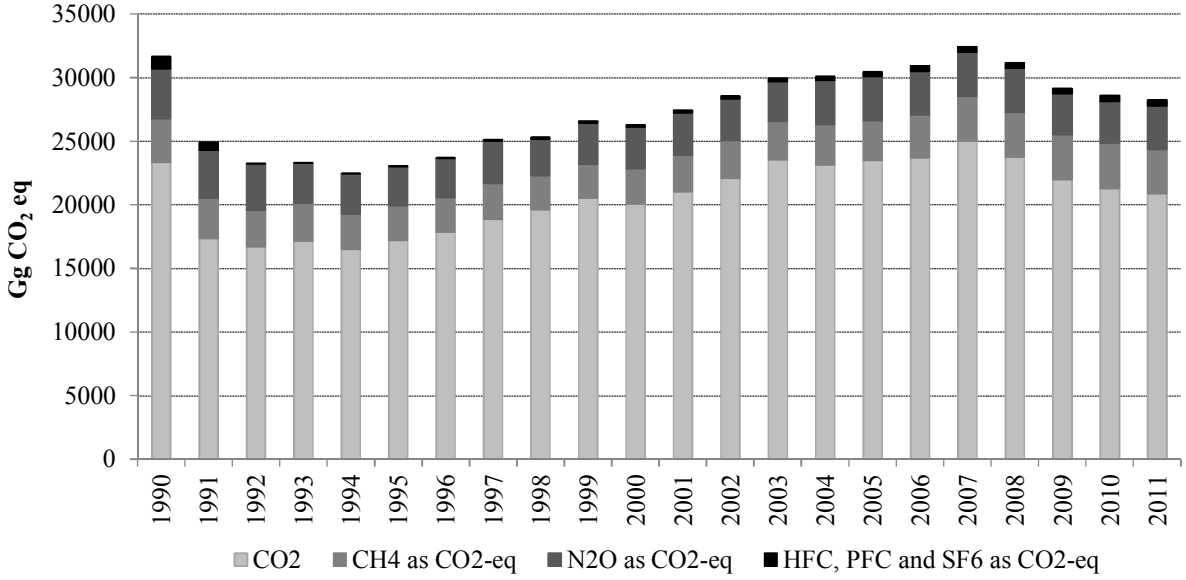

Figure 1.3-1: Trend of GHG emissions, by gases

The shares of GHG emission have not significantly changed during the entire period. In 2011, the shares of GHG emissions were as follows: 73.4 percent CO_2; 12.6 percent CH_4; 12.3 percent N_2O; 1.7 percent HFCs and PFCs and 0.03 percent SF_6.

The trend of aggregated emissions, divided by sectors, is shown in Figure 1.3-2.

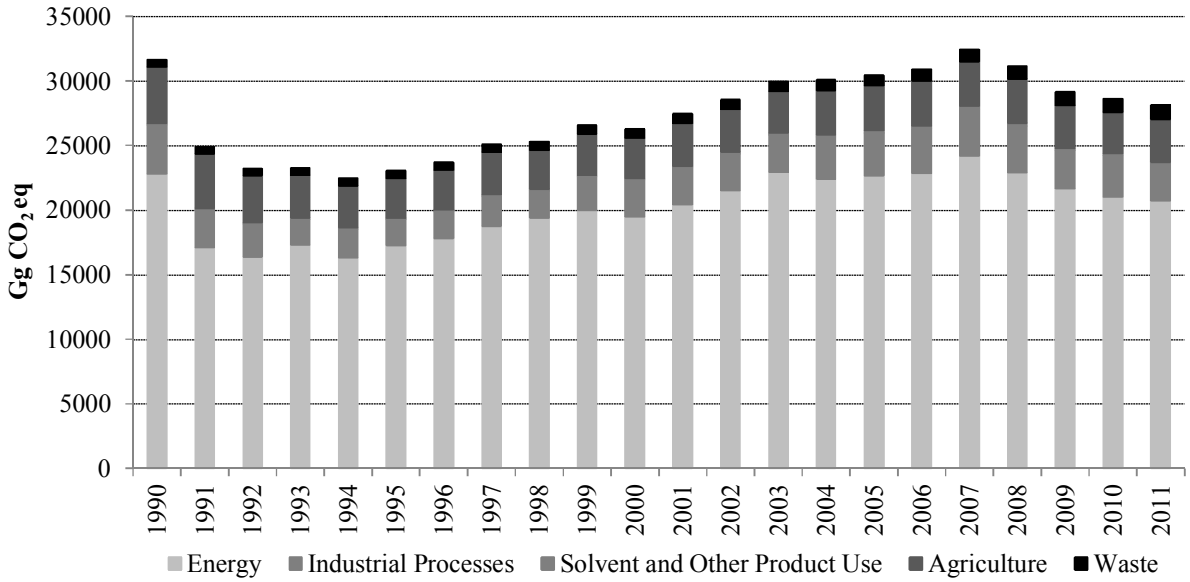

Figure 1.3-2: Trend of GHG emissions, by sectors

The most important IPCC sector in Croatia is Energy sector, which accounted for some 72.9 percent of the total national GHG emissions. In 2011, the GHG emission from Energy was 1.4 percent lower in relation to 2010 and 9.1 percent lower than emission in 1990. The total energy consumption in 2011 was 0.4 percent lower than in the previous year. The consumption of gaseous fuel has decreased (4.5 percent) but consumption of solid fuel has increased for 4.8 percent and also consumption of fuel wood and other renewables has increased (14.8 percent in

relation to 2010). In 2011, the total electricity production was 23.2 percent lower than in the former year. Hydro power utilization has decreased by 45.2 percent because of unfavourable hydrological conditions. Increase in energy consumption from thermal power plants, public and industrial cogeneration plants was 31.1 percent. Electricity production in wind power plants was increased for 44.5 percent in relation to 2010. The import of electricity was about 30 percent of total electricity consumption in Croatia.

Industrial Processes contributes to total GHG emission with 10.6 percent in 2011. Due to decreasing of economic activity after 2008, which influenced decreasing of cement, lime and steel productions, in 2011 emissions from this sector have dropped by 16.5 percent, regarding 2008. In 2011, cement production was decreased by 2.6 percent, lime production by 12.9 percent and steel production by 7.3 percent, regarding 2010. On the other hand, in 2011 ammonia production increased by 2 percent, regarding 2010. In 2011 emissions were decreased by 6.6 percent, regarding 2010, and by 20.8 percent, regarding 1990.

Solvent and Other Product Use contributes to total GHG emission with 0.5 percent in 2011. The GHG emission in 2011 was 23.2 percent larger than emission in 1990 since new activity data, regarding sub-sector Other use of solvent, were included in the emission calculation.

Agriculture contributes to total GHG emission with 12.1 percent in 2011. The GHG emissions from Agriculture have been decreasing from 2006 mainly due to the decrease in the number of cattle. The GHG emission in 2011 was 21.4 percent lower in comparison with 1990.

Waste contributes to total GHG emission with 3.9 percent in 2011. Emissions from Waste sector have been constantly increasing in the period 1990-2011 as a consequence of greater quantities of waste, activities in waste water handling and waste incineration. The GHG emission in 2011 was 91 percent larger in comparison with 1990.

1.4. Policies and measures

Policies and measures for reduction of the emissions and mitigation of the climate change are in the function of fulfilling the Croatian international obligations under the Convention, the Kyoto Protocol and the EU acquis and the starting point for long-term development of the economy with low emissions of greenhouse gases. In this context, the priority objective of the Croatia is fulfilment of the obligations under the Kyoto Protocol in reducing greenhouse gas emissions by 5% in the period 2008-2012 compared to year 1990.

According to current trends and projections it is very likely that Croatia will achieve this goal. Assigned amount units, representing a quota of emissions of Croatian, for the period 2008-2012 amounts to 148,778,503 tonnes CO2-eq while cumulative emissions in the period 2008-2011 totalled 117,918,524 tonnes CO2-eq with constant annual trending downward (final emissions data for the year 2012 shall be determined in the year 2014). With Croatian accession to the European Union, the Republic of Croatia has taken a common European objective of reducing greenhouse gas emissions by 20% by 2020 compared to 1990 with a conditional option to decrease them by 30% if other states take comparable goals, as listed in Annex B of the Kyoto Protocol adopted at the 18th Conference of the Parties to the UNFCCC in Doha, Qatar.

A key factor in the implementation of policies and measures to reduce greenhouse gas emissions will be the efficiency of using the EU structural funds and investment funds. As part of the Common Strategic Framework for the funding of programs and projects, the implementation of policies and measures meets the strategic objectives of the EU, among others, in terms of reducing greenhouse gas emissions, as expressed in the document *Europe 2020: A strategy for smart, sustainable and inclusive growth* (COM (2010) 2020 final). It should be emphasized that at least 20% of the total EU budget for the period 2014-2020 will be allocated for the implementation of policies, measures and projects related to the mitigation and adaptation to climate change, including the integration of these issues into the other sectoral policies (development, agriculture, cohesion, etc.).

With backing from the United Nations Development Programme (UNDP), a development of the framework for the long term low-emission development strategy for Croatia until 2050 has been launched. It through the broad cooperation of stakeholders across sectors (energy, industrial processes, transport, buildings, agriculture, forestry, tourism and waste management) analysed the possible instruments and measures for achieving the long-term goal of reducing the greenhouse gas emissions by 80-95% by 2050 compared to 1990.

The main planning document for specific five-year period is The Plan for the Protection of the Air, the Ozone Layer and Climate Change Mitigation in the Republic of Croatia. With it is determined the objectives, priorities and measures for reducing of the greenhouse gas emissions and the way, order, terms and entities for measure implementation. Current active period is from 2013 until 2017 (OG, 139/2013). The measures adopted by this Plan will ensure the implementation of Croatian legislation and the acquis communautaire, which are transferred to the Croatian legislation in the field of protection of the air, the ozone layer and climate change mitigation.

Below is a review of policies and measures for the reduction of the emissions and increase of the sinks of the greenhouse gases in the Republic of Croatia in the period 2013-2017:

Emissions trading system and carbon capture and storage (CO_2, CH_4, N_2O):

- MSP-1 Inclusion of the plant operators and aircraft operators in the European union emission trading system (EU ETS) in the full scale from 1 January 2013
- MSP-2 Adoption of the Plan for use of funds obtained from the sales of emission allowances through auctions
- MSP-3 Preparation of National feasibility study with the action plan for the preparatory activities for CCS projects in Croatia

Energy and combustion in industrial processes (CO_2, CH_4, N_2O):

- MEN-1 Promotion of energy efficiency in households and services through project activities
- MEN-2 Energy audits in industry
- MEN-3 Measurement and informative calculation of energy consumption
- MEN-4 Promotion of the construction of cogeneration
- MEN-5 Labelling the energy efficiency of household appliances
- MEN-6 Eco-design of energy-using products
- MEN-7 Supporting the use of renewable energy sources in electricity production
- MEN-8 Promotion of the construction of cogeneration

- MEN-9 Usage of biodegradable fraction of municipal waste in public electricity and heating plants
- MEN-10 Usage of refused derived fuel in the cement industry
- MEN-11 Promotion of the use of renewable energy sources in heat/cooling energy production
- MEN-12 Promotion of the use of renewable energy sources and energy efficiency by HBOR-a (Croatian Bank for Reconstruction and Development)
- MEN-13 Promotion of the use of renewable energy sources and energy efficiency by FZOEU (Fund for Environmental Protection and Energy Efficiency) resources
- MEN-14 Energy efficiency projects with implementation through the energy services

Transport (CO_2, CH_4, N_2O):
- MTR-1 Prescribing limit values for components and characteristics of liquid petroleum fuels
- MTR-2 Providing information to consumers on fuel economy and CO2 emission of new passenger cars
- MTR-3 The implementation of the pilot project and the establishment of the training of drivers of road vehicles for eco-driving
- MTR-4 Promotion of the production and use of biofuels in transport
- MTR-5 Modification of the system for special fee payment for the environment for the motor vehicles
- MTR-6 Financial incentives for the purchase of hybrid and electric vehicles
- MTR-7 Development of infrastructure for electric vehicles in urban areas
- MTR-8 Development of sustainable transport systems in urban areas

Industrial processes (fluorinated greenhouse gases):
- MOS-1 Ban and reduction of consumption of controlled and new substances and fluorinated greenhouse gases
- MOS-2 Technical and organizational measures for collecting, recycling and recovering controlled substances and fluorinated greenhouse gases
- MOS-3 Preventive measures for uncontrolled leaking

Agriculture (CH_4, N_2O):
- MSP-4 Preparation of Study about possibilities of applying measures to reduce greenhouse gas emissions in the agricultural sector

Forestry (CO_2):
- MSP-5 Improving the reporting from LULUCF sector
- MSP-6 Preparation of cost-benefit analysis of reforestation on new surfaces and biological regeneration of forests as a measure of increasing sinks in LULUCF sector
- MSP-7 Revision of reference levels for Forest Management (FMRL) under Article 3.4 of the Kyoto Protocol for the second commitment period
- MSP-8 Development of Action plan for LULUCF sector

Waste management (CO_2, CH_4, N_2O):
- MSP-9 Avoiding generation and reducing the quantity of municipal waste
- MSP-10 Increasing the quantity of sorted and recycled municipal waste

- MSP-11Increasing the population coverage of organized municipal waste collection system
- MSP-12 Methane flaring or using methane as fuel for electricity production
- MSP-13 Reducing the quantities of disposed biodegradable municipal waste
- MSP-14 Production of fuel from waste
- MSP-15 Use of biogas from bioreactors for electricity and heat production
- MSP-16 Thermal treatment of municipal waste and sludge from wastewater treatment

Cross-sectoral measures (CO_2, CH_4, N_2O):

- MSP-17 Establishing a monitoring, reporting and verification of greenhouse gas emissions in the lifetime of liquid fuels
- MSP-18 CO2 emission tax
- MSP-19 The establishment of the Committee for cross-sectoral coordination for policies and measures to mitigate and adapt to climate change
- MSP-20 Intensifying the use of innovative information and communication technologies (ICT) to reduce greenhouse gas emissions

1.5. Projections and the total effect of policies and measures

Projections are presented for three scenarios: the 'without measures' scenario, 'with measures' scenario and 'with additional measures' scenario. Scenario 'without measures' assumes that implementation of adopted policies and measures as well as implementation of planned policies and measures, will not happen. Scenario 'with measures' assumes a consistent application of policies and measures, which application is already in progress and the application of adopted policies and measures, which application is likely, but still not begun. Scenario 'with additional measures' is based on the application of planned policies and measures. Historical emissions and total projections of greenhouse gas emissions are presented in Figure 1.5-1 and in Table 1.5-1.

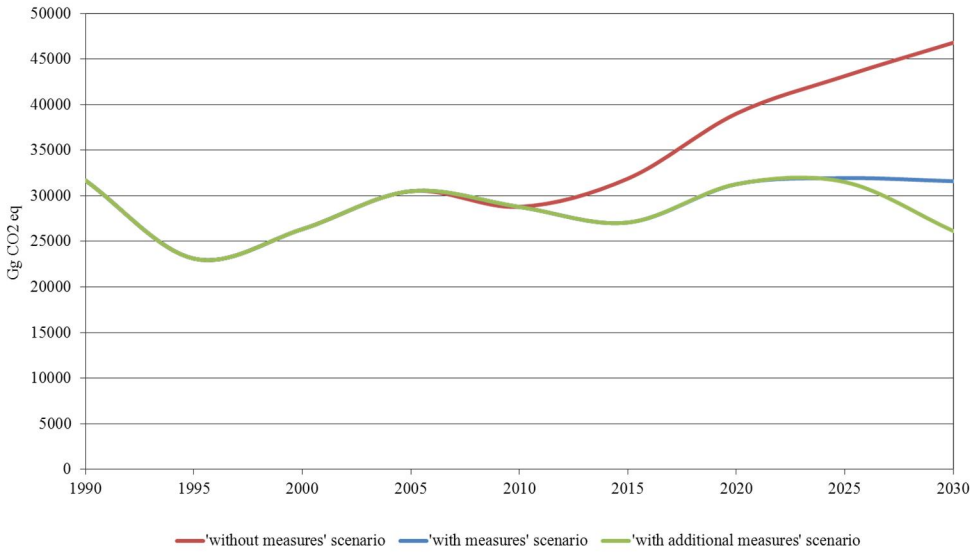

Figure 1.5-1: Historical and total projected greenhouse gas emissions

Table 1.5-1: Historical and total projected greenhouse gas emissions, Gg CO2-eq

'Without measures' scenario	1990	1995	2000	2005	2010	2015	2020	2025	2030
Energy	18701	13797	14885	16991	14970	16575	22630	26043	29238
Transport	4095	3466	4597	5681	6040	6793	7059	7179	7185
Industry	3906	2124	2970	3489	3364	3632	3958	4313	4730
Waste management	611	667	761	864	1092	1366	1608	1643	1679
Agriculture	4381	3055	3130	3478	3316	3511	3747	3948	3948
TOTAL	**31693**	**23110**	**26344**	**30503**	**28781**	**31876**	**39002**	**43127**	**46781**

With measures' scenario	1990	1995	2000	2005	2010	2015	2020	2025	2030
Energy	18701	13797	14885	16991	14970	13630	17027	17635	17245
Transport	4095	3466	4597	5681	6040	6260	6643	6209	5910
Industry	3906	2124	2970	3489	3364	2717	3009	3325	3703
Waste management	611	667	761	864	1092	1018	922	899	875
Agriculture	4381	3055	3130	3478	3316	3439	3668	3866	3866
TOTAL	**31693**	**23110**	**26344**	**30503**	**28781**	**27065**	**31269**	**31934**	**31599**

With additional measures' scenario	1990	1995	2000	2005	2010	2015	2020	2025	2030
Energy	18701	13797	14885	16991	14970	13630	17027	17510	12419
Transport	4095	3466	4597	5681	6040	6260	6643	6209	5310
Industry	3906	2124	2970	3489	3364	2717	3009	3325	3703
Waste management	611	667	761	864	1092	1018	922	899	875
Agriculture	4381	3055	3130	3478	3316	3439	3668	3866	3866
TOTAL	**31693**	**23110**	**26344**	**30503**	**28781**	**27065**	**31270**	**31808**	**26173**

1.6. Vulnerability assessment, climate change impacts and adaptation measures

Climate change in Croatia over the period 1961-2010 has been determined by trends in annual and seasonal mean air temperature, mean minimum and mean maximum temperature; and in indices of temperature extremes; then in precipitation amounts and precipitation indices, as well as in dry and wet spells.

Trends in air temperature (mean, mean minimum and mean maximum temperature) in the last 50 years (1961-2010) show warming all over Croatia. Annual temperature trends are positive and significant, and the changes are higher on the mainland than at the coast and the Dalmatian hinterland. Observed warming can be seen in all indices of temperature extremes, with positive trends of warm temperature indices (warm days and nights as well as warm spell duration index) and with the negative trends of cold temperature indices (cold days and nights and cold spell duration index).

The hottest year 2007 was for 1.5 ° C warmer than the mean of the standard period 1961-1990., the coldest year 2005 was 0.1 ° C colder. During the decade 2001-2010, spatial mean air temperature in nine years was higher than the corresponding referent averages.

During the recent 50-year period (1961-2010) the annual precipitation amounts experienced prevailing insignificant trends that are increasing in the eastern lowland and decreasing elsewhere. The statistically significant decreases are found for the stations in the mountainous region of Gorski kotar and in the Istria peninsula (northern Adriatic) as well as in the southern coastal region.

Changes of trend in dry and wet spells in Croatia are presented by annual and seasonal of their maximum lengths. The most prominent feature of time trend is found for dry spells during autumn for which a spatially consistent statistically significant negative trend is found. For the

rest of the seasons trends in dry spells of both categories are less consistent in magnitude and direction.

1.7. Financial resources and transfer of technology

Article 4, paragraph 3 of the Convention stipulates that developed country Parties and other developed Parties included in Annex II shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1. They shall also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing measurs that are covered by Article 4, paragraph 1 of the Convention.

As Annex I country of the Kyoto Protocol with economy in transition, the Republic of Croatia has not been in a position so far to start activities related to financing transfer of knowledge and/or technologies in the field of environmental protection and climate change to developing countries. However, during the accession process to the European Union, the Republic of Croatia was beneficiary of EU funds allocated to the candidate countries and potential candidates through the horizontal component of EU programs such as regional CARDS and PHARE program and the horizontal component of the IPA multi-beneficiary program.

1.8. Research and systematic observation

Global Climate Observation System

Global Climate Observation System (GCOS) was established in 1992 and the Republic of Croatia, represented by the Meteorological and Hydrological Service, has been its member since then. This system includes observation in all parts of the climate system – in the atmosphere, ocean, sea and land. It is intended to define and cover all the observations required for monitoring the climate system including satellite observations at the global, regional and national levels, and to create conditions for observation enhancement.

Global Earth Observation System of Systems (GEOSS) is a new initiative taken with the objective to co-ordinate and enhance all current observing systems at the global level in support of the requirements of user areas: natural disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity. The Republic of Croatia joined the GEOSS in 2004.

Data collection and systematic observations in Croatia

Croatian institutions that maintain observing systems in the climate segments of atmosphere, sea and land and biodiversity are: Meteorological and Hydrological Service, State Institute for Nature Protection, Ministry of Maritime Affairs, Transport and Infrastructure, Ministry of Environmental and Nature Protection, Institut for Medical Research, Public Health Institute, Institute for Oceanography and Fisheries, Croatian Hydrographic Institute, "Ruđer Bošković" Institute, "Andrija Mohorovičić" Geophysical Institute and Croatian Forest Research Institute.

1.9. Education, training and public awareness

System of education in the Republic of Croatia consists of pre-school education, primary education, secondary education and higher education. Ministry of Science, Education and Sports, which is in charge of institutional education, holds a position that environmental awareness of students should be developed, and environmental education conducted, through the entire system of education. Education on climate change does not exist as a separate topic or activity but is already contained within the environmental education or in the summarized form in some of the regular subjects. Year by year, at several institutional points in the Croatian society, the number of workshops, seminars, round tables and various publications on the topic of climate change and the related issues gradually increases. The civil sector in the field of environmental protection in the Republic of Croatia, especially some NGOs, has been intensely active in regard to topics related to climate change through education and projects during the period 2009-2013.

In addition, there are many reputable vocational and professional institutions in the Republic of Croatia that have been implementing over a long period continuous programme and project activities related to providing information and education of professional community but also of the interested public community and business entities on climate change and the concrete mitigation measures and instruments.

2. NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

2.1. Social-political structure

The Republic of Croatia became an independent state on 8 October 1991 by a decision of the Croatian Parliament. The Croatian Constitution was adopted on 22 December 1990. The Republic of Croatia is a member of the United Nations since 22 May 1992 and the European Union since 1 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. Under the Constitution, the Croatian Parliament is a unicameral representative body which may have at least 100 and no more than 160 members on the basis of universal and equal suffrage by secret ballot. Deputies are elected for four years, have no binding mandate and have immunity. The working bodies of the Parliament for specific sectorial issues are boards and committees, including the Committee for Environmental Protection.

The Croatian President has a representative and executive function and can be elected to a maximum of two terms. He represents the Republic of Croatia at home and abroad. He is responsible for the defence of the independence and territorial integrity of the Republic of Croatia, as well as stable, normal and concerted action by the state government. The president is elected through direct elections by secret ballot for a period of five years. In cooperation with the Croatian Government, the President participates in the formulation and implementation of foreign policy. The President performs other duties specified by the Constitution.

The Government of the Republic of Croatia exercises the executive power in conformity with the Constitution and the law. The Government consists of the Prime Minister, Deputy Prime Ministers and Ministers and assumes the office when given a vote of confidence by the majority of all members of the Croatian Parliament. The organization, operation and decision-making are regulated by the Law on the Government of the Republic of Croatia and its rules of procedure. The Government of the Republic of Croatia proposes laws and other acts to the Croatian Parliament, the state budget and final financial statement, implements the laws and other decisions of the Croatian Parliament, adopts regulations for the enforcement of laws, conducts the foreign and domestic policy, directs and controls the work of the state administration, takes care of economic development of the country, directs and controls activities and development of public services and conducts other affairs as determined by the Constitution and the law. The Government of the Republic of Croatia, besides the aforementioned, within the framework of its authorities, adopts regulations, administrative acts and decisions on appointing and releasing of officials and public servants. The Government of the Republic of Croatia makes a decision in case of conflict for jurisdiction of public institutions, gives answers on representatives' questions, establishes proposals of laws and other regulations, gives opinion on laws and other regulations and adopts development strategies of economic and social activities. The Government of the Republic of Croatia is responsible to the Croatian Parliament. The Prime Minister and members of the Government of the Republic of Croatia are responsible for decisions made by the Government of the Republic of Croatia and individually they are responsible for their fields of operation.

The judicial power in the Republic of Croatia is exercised by magistrate courts, municipal courts, county courts, commercial courts, High Magistrate Court of the Republic of Croatia, High Commercial Court of the Republic of Croatia, High Administrative Court of the Republic of Croatia and Supreme Court of the Republic of Croatia.

The State Administration is responsible for direct enforcement of laws, adoption of regulations for their enforcement, carrying out administrative and inspection supervision, as well as other administrative and expert activities. The activities of State Administration are carried out by state administration bodies and certain activities could be entrusted to the local and regional self-government units and other legal entities having public authorities. The government bodies comprise 20 ministries, 4 state administration offices, 8 state bureaus and 20 county offices of government bodies. The Ministry of Environmental and Nature Protection is the central government authority in charge of administrative and expert environmental protection activities relating to the horizontal legislation, air quality, climate and ozone layer protection, soil protection, waste management, protection of the sea and marine environment, industrial pollution control and risk management. The Ministry of Agriculture is the central government authority in charge of, among other things, administrative and expert activities in the field of agriculture, fishery, forestry and water management and thus responsible for water protection, irrigation and land drainage, water and ice adverse effect protection, erosion and flood protection, water exploitation for various purposes, as well as for activities of public water supply and sewage and waste water treatment. Apart from the central government bodies there are other bodies dealing with environmental protection issues such as the Croatian Environment Agency established in 2002, the Environmental Protection and Energy Efficiency Fund established in 2003, the State Institute for Nature Protection and the Croatian Waters.

Local and regional self-government is a citizen right guaranteed by the Constitution of the Republic of Croatia. Right to local and regional self-government includes right to: independence in carrying out local activities, own incomes, free income management, independent organization of internal structure, independent organization of scope of activities and direct election of members of representative bodies. Right to local and regional self-government is acquired by local and regional bodies comprised of members elected through direct elections by secret ballot, based on direct, equal and general voting right. Citizens are allowed to directly participate in local activities management through meetings, referendums and other forms of direct decision making in accordance with law and statute. Local self-government units are municipalities and cities responsible for issues of local importance directly fulfilling the citizens' needs.

The Republic of Croatia territory is administratively divided into 128 cities and 428 municipalities. Municipalities and cities in the Republic of Croatia represent the lowest level of self-government. Regional self-government units are counties responsible for activities of the regional importance. The Republic of Croatia is divided into 21 regional self-government units: 20 counties and the City of Zagreb with the county status. County includes physically connected municipalities and cities in its area.

2.2. 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. The average population age in 2011

was 41.7 years (43.4 for women and 39.9 for men). The expected lifetime in 2011 was 79.9 for women and 73.8 for 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. The natality rate amounted 9.4‰, while the mortality rate was 11.6‰. 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. In 2011, there was 8,534 persons moved in to the Republic of Croatia, while 12,699 persons moved out.

The area of the Republic of Croatia is not equally populated. In 2011, the average population density amounted 75.7 inhabitants/km^2 (table 2.2-1).

Table 2.2-1: Population density per counties in 2011

Counties	Population per km^2
Zagreb	103.8
Krapina-Zagorje	108.1
Sisak-Moslavina	38.6
Karlovac	35.5
Varaždin	139.4
Koprivnica-Križevci	66.1
Bjelovar-Bilogora	45.4
Primorje-Gorski kotar	82.6
Lika-Senj	9.5
Virovitica-Podravina	41.9
Požega-Slavonija	42.8
Slavonski Brod-Posavina	78.1
Zadar	46.6
Osijek-Baranja	73.4
Šibenik-Knin	36.7
Vukovar-Srijem	73.2
Split-Dalmacija	100.2
Istra	74
Dubrovnik-Neretva	68.8
Međimurje	156.1
City of Zagreb	1232.5

Source: 1) Data of the State Geodesic Administration (calculated from the graphic database of official spatial units registry), as at 31 March 2011, are related to the land area

2.3. 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^2. It is located between 42°23′ and 46°33′ of north latitude and 13°30′ and 19°27′ of east longitude. The inland area amounts 56,594 km^2, while the area of territorial sea and internal sea waters amounts 31,067 km^2. Total length of inland borders of the Republic of Croatia towards neighbouring countries amounts 2,374.9 km (including river borders). The length of inland border towards Bosnia and Herzegovina amounts 1,011.4 km, Hungary 355.5 km, Slovenia 667.8 km, Serbia – Vojvodina 317.6 km and Montenegro 22.6 km. The length of sea coast amounts 6,278 km (29.9% of inland, 70.1% of islands). The state sea border is 948 km long and extended at outer boundary of territorial sea. The Ecological and Fisheries Protection Zone of 23,870 km^2 reaches epicontinental border between the Republic of Croatia and Italy.

There are three large geomorphological natural units in the Republic of Croatia: the Pannonian basin, mountain system of Dinarides and Adriatic basin. Lowland areas of up to 200 m a.s.l. represent 53% of area of the Republic of Croatia, hillies and sub-mountains from 200 up to 500 m represent 26%, while there is 21% of mountain areas exceeding 500 m.

The highest mountain top in the Republic of Croatia is Dinara (1,831 m a.s.l.). Carstic area is relief particularity occupying about 54% of the Republic of Croatia territory. Karstic forms are developed particularly in limestones in mountainous and coastal area of Croatia and as separated form in Sava-Drava area.

In 2011, used agricultural area occupied 23.4%, while forest area occupied 39.4% of the Republic of Croatia territory[2].

Spatial distribution of group categories of land cover in the Republic of Croatia for 2006 is indicated in Figure 2.3-1.

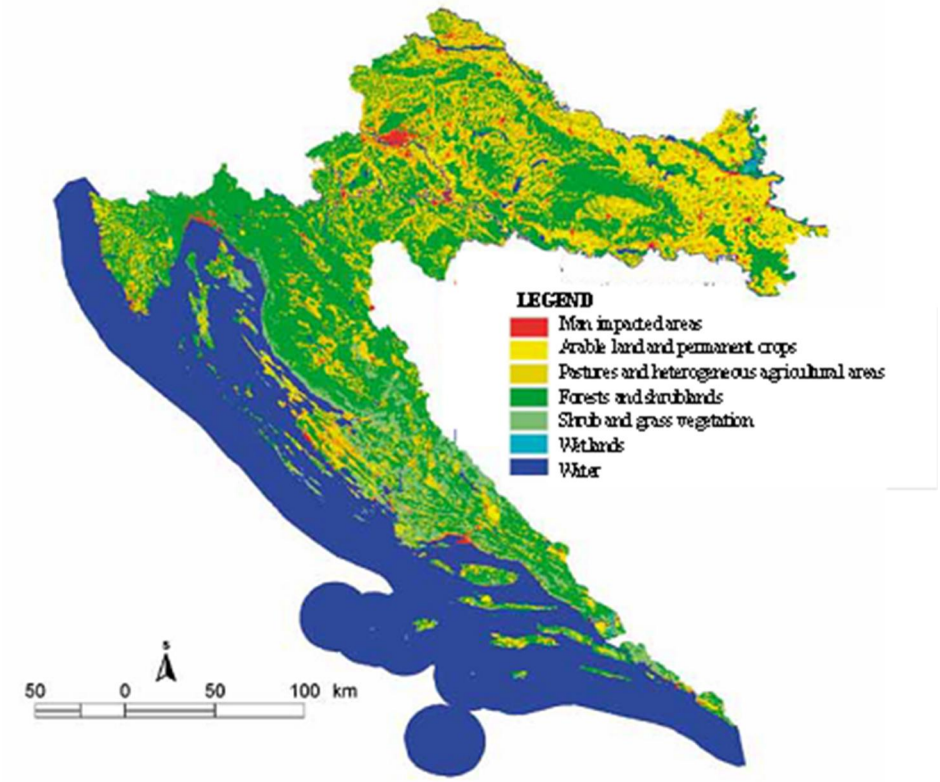

Figure 2.3-1: Spatial distribution of group categories of land cover in the Republic of Croatia for 2006[3]

The Nature Protection Act (OG, 80/2013) defines nine categories of protected areas (strict nature reserve, national park, special nature reserve, nature park, regional park, natural monument, significant landscape, park-forrest and park architecture monument). Total of 420 areas is protected in nine aforementioned categories. Protected areas include 8.56% of total area of the

[2] Statistical Yearbook 2012.
[3] Source: Environmental Protection Agency, Corine Land Cover, Land Cover and Land Use in the Republic of Croatia – state and trends, Zagreb, 2010

Republic of Croatia, i.e. 12.20% of inland territory and 1.94% of territorial sea. A majority of protected area are nature parks (4.54% of total state territory).[4]

2.4. 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. The southernmost part of the island of Lošinj, the Dalmatian coast and islands have the Mediterranean climate with dry and hot summers (Csa), whereas the coastal areas of Istria, the Kvarner littoral and the Dalmatia's interior have a moderately warm and humid climate with hot summers (Cfa). The moderately warm and humid climate with warm summers (Cfb) prevails in the major part of Croatia, in the continental Pannonian region and the interior of Istria. Only the regions of Gorski kotar, Lika and the Dinaric Alps above altitude of 1200 m belong to the climate type D, subtype Df, a humid snowy forest climate.

The annual mean air temperature in the lowland area of northern Croatia is 10-12°C, at altitudes above 400 m it is under 10 °Clower and in the mountains it is 3-4°C. In the coastal area it is 12-17°C. January is the coldest month on average, with the temperature in the Pannonian region ranging from 0 to -2°C. Along the Adriatic coast winters are milder; January temperatures are 4-6°C. In the north and east of Croatia average July temperatures are 20-22°C and on the Adriatic coast 23-26°C. The absolute minimum temperature of -35.5°C was measured in Čakovec on 3 February 1929 and the absolute maximum of 42.8°C in Ploče on 5 August 1981.

The least precipitation in Croatia is recorded in the open part of the central Adriatic (Palagruža, 304 mm) and in the eastern Slavonia and Baranja (Osijek, 650 mm). Central Croatia and the coastal zone have annual precipitation between 800 and 1,200 mm. The amount of precipitation in the Pannonian region decreases from the west towards the east. From the coast towards the inland the precipitation increases. Most of the precipitation is recorded on the coastal slopes and peaks of the Dinarides (Risnjak, 3,470 m), from Gorski Kotar in the northwest to the southern Velebit in the southeast.

In Croatia's inland the north-easterly winds prevails. Bora (bura) is a cold descending wind blowing from the north-eastern direction on the eastern Adriatic coast. It blows in gusts over 110 km/h, which sometimes can exceed 250 km/h. It is more frequent and stronger in winter than in other seasons. Sirocco (jugo) is a warm and wet, moderate or strong south-easterly wind accompanied by cloudy and rainy weather. It is the most frequent and the strongest in the cold half of the year. It is stronger on the open sea, making the waves up to 10 m high.

The duration of sunshine depends directly on the cloudiness. The coastal zone from Dugi otok to Prevlaka is the fairest part of Croatia with the annual cloudiness of 4/10. The islands of the central and southern Adriatic (Hvar, Vis and Korčula) have 2,700 hours of sunshine per year. The majority of inland places in Croatia have 1,800-2,000 hours of sunshine. The annual largest cloudiness is recorded in Gorski kotar (6-7/10), which has the least hours of sunshine yearly – about 1,700.

[4] Ministry of Environmental and Nature Protection, source: Registry of protected areas (as at December 2013)

2.5. Economy

In 2011, the Croatian economy recorded a period of stagnation of real economic activity (GDP - 0.2%), while gross domestic product (GDP) in 2011 amounted 328,737 millions of HRK (44,220 millions of EUR), which amounts HRK 76,755 per capita (EUR 10,325 per capita) (table 2.5-1). In 2009, there was a significant deceleration of economic activity due to spillover of consequences of global crisis, thus gross domestic product was reduced to 6.9%, which is the lowest growth rate since 1999. During 2010, there was a mitigation of these negative trends. Selected macroeconomic indicators for the Republic of Croatia and their trend within the period 2008-2011 are indicated in table 2.5-1.

Table 2.5-1: Macroeconomic indicators for the Republic of Croatia within the period 2008-2011

Macroeconomic indicator	**2008**	**2009**	**2010**	**2011**
GDP (mil. HRK)	343,412	328,672	323,807	328,737
Average annual exchange rate HRK/EUR	7.2232	7.3396	7.2862	7.4342
Population, annual population average, thous.	4,311	4,306	4,296	4,283
GDP (mil. EUR)	47,543	44,781	44,441	44,220
GDP per capita (HRK)	79,662	76323	75,386	76,755
GDP per capita (EUR)	11,029	10,399	10,344	10,325
Growth rate (%)	2.1	-6.9	-2.3	-0.2
Average annual inflation rate expressed by annual consumer price index growth (%)	6.1	0.2	1.1	2.3
Export of goods and services (% GDP)	41.7	35.4	38.6	40.9
Import of goods and services (% GDP)	49.7	39.8	38.6	40.9
External debt (million EUR end of the period)	40,590	45,244	46,483	45,734
Unemployment rate (%, according to ILO)	8.4	9.1	11.8	13.5

Source: Statistical Yearbook 2012; Notice 121.6. Annual gross domestic product for 2011, CBS

Macroeconomic projections for the period 2013-2015 are based on the Guidelines for the Economic and Fiscal Policy for the period 2013 – 2015 in order to determine the direction of fiscal policy in the next three years, adopted by the Government of the Republic of Croatia in July 2012. Real growth of gross domestic product is projected to accelerate by the end of the projection period. A growth rate of 1.8% is projected for 2013, 3.0% for 2014, and 3.5% for 2015. Economic recovery is projected to be driven by the positive contribution of domestic demand. Projected economic trends in Croatia in the observed period will be bolstered by more favorable economic trends in the international environment, primarily stronger economic activity in the European Union. European Union is the main Croatian foreign-trade partner with 65% of total foreign trade.

2.6. Energy

Primary energy generation in the period from 2006 to 2011 is described in table 2.6-1. Primary energy generation in 2011 was decreased by 18% from the previous year. Due to unfavorable hydrology, hydro power utilization decreased by as much as 46.6%. The production of natural gas, crude oil and heat generated by use of heat pumps also decreased. The natural gas production decreased by 9.4%, of crude oil by 7.6 % and of heat by 1.7 %. The production of fuel wood and biomass and of other renewables increased in 2011 by 34% in relation to 2010. Renewable energy sources include wind energy, solar energy, geothermal energy, biodiesel and biogas, which total generation in 2011 increased by 12.9% in relation to 2010.

Table 2.6-1: Primary energy generation in the period 2008-2011

Primary energy generation, PJ	**2008**	**2009**	**2010**	**2011**
Fuel wood and biomass	17.01	17.97	19.96	26.74
Crude oil	35.42	33.07	30.69	28.37
Natural gas	94.05	93.5	93.88	85.02
Hydro power	50.19	65.77	79.71	42.59
Heat	1.25	1.48	1.76	1.73
Renewable sources	1.01	1.3	2.63	2.97
TOTAL	198.93	213.09	228.62	187.42

Source: Energy in Croatia 2011, Ministry of Economy

Table 2.6-2 shows energy import in the period from 2006 to 2011. In 2011, total energy import in Croatia decreased by 5.2% from the previous year. Import of crude oil, natural gas and of coal and coke decreased, while the import of electricity, petroleum products and fuel wood and biomass increased. The import of crude oil fell by 19.5%, of natural gas by 18.1% and of coal and coke by 3.7%. The import of electricity increased by 30.6%, of petroleum products by 26.5% and of fuel wood and biomass by 15.0%.

Table 2.6-2: Energy import in the Republic of Croatia within the period 2008-2011

Energy import, PJ	**2008**	**2009**	**2010**	**2011**
Coal and coke	39.26	23.21	33.13	31.92
Crude oil	147.27	172.45	150.64	121.2
Petroleum products	79.01	46.54	53.81	68.05
Natural gas	41.71	35.5	36.37	29.79
Electricity	29.39	27.29	24.06	31.43
Wood and biomass	0.11	0.38	0.2	0.23
TOTAL	336.74	305.37	298.2	282.61

Source: Energy in Croatia 2011, Ministry of Economy

The shares in energy that was exported from Croatia in the period from 2006 to 2011 are given in table 2.6-3. In 2011, the annul energy export from Croatia was decreased by 20.1%. In this, the export of all energy products was lower than the previous year, except for the export of wood and biomass which was 75.2% higher. The export of coal and coke decreased by 58.7%, of natural gas by 46.6%, of electricity by 46.1% and of petroleum products by 17%.

Table 2.6-3: Energy export from the Republic of Croatia within the period 2008-2011

Energy export, PJ	**2008**	**2009**	**2010**	**2011**
Coal and coke	1.08	0.69	1.67	0.69
Wood and biomass	3.38	3.84	4.52	7.92
Petroleum products	73.02	79.69	80.34	66.71
Natural gas	23.66	27.37	16.46	8.79
Electricity	5.71	6.83	6.9	3.72
TOTAL	106.85	118.43	109.89	87.83

Source: Energy in Croatia 2011, Ministry of Economy

The shares of specific energy forms in total primary energy supply during the period 2006-2011 are given in table 2.6-4. In 2011, total primary energy supply in Croatia was lower by 6.8% from the previous year. Hydro power decreased by 46.6%, the consumption of natural gas decreased by 2.5%, of liquid fuels by 2.1% and of heat from heat pumps by 1.7%. The consumption of other energy forms was higher than the previous year. The imported electricity consumption increased by 61.6% and of renewables by 26.8%. Also, total consumption of fuel wood and biomass increased by 19.8% and of coal and coke by 2.4%.

Table 2.6-4: Total primary energy supply in the Republic of Croatia within the period 2008-2011

Primary energy supply, PJ	**2008**	**2009**	**2010**	**2011**
Coal and coke	34.65	24.66	30.92	31.66
Wood and biomass	13.8	14.42	16.05	19.23
Liquid fuels	180.15	178.04	152.54	149.3
Natural gas	110.22	102.15	111.37	108.6
Hydro power	50.19	65.77	79.71	42.59
Electricity	23.68	20.46	17.15	27.71
Heat	1.25	1.48	1.76	1.73
Renewable sources	0.95	1.39	2.24	2.84
TOTAL	414.9	408.37	411.73	383.65

Source: Energy in Croatia 2011, Ministry of Economy

Total primary energy supply is the amount of energy that meets all demand for energy in an energy system – total final energy consumption, non-energy use, energy sector own use, energy conversion losses, and energy transport and distribution losses. The structure of energy needs during the period from 2006 to 2011 is given in table 2.6-5. In 2011, total energy consumption decreased by 6.8% from the previous year. In this, energy sector own needs increased by 6.0%, while all other energy needs that make primary energy supply were reduced. Energy conversion losses decreased by 28.2%, while transport and distribution losses by 6.8%. Final energy consumption decreased by 2.5% and non-energy use by only 0.1%. The structure of final energy consumption is indicated for three characteristic sectors of final consumers – industry, transport and other sectors. In relation to the energy consumption in 2010, energy consumption in industry in 2011 was decreased by 6.6%. Energy consumption in transport was also decreased by 2.1%, as well as energy consumption in other sectors by 1.1%.

Table 2.6-5: Total primary energy supply in the Republic of Croatia within the period 2008-2011

Total primary energy supply, PJ	**2008**	**2009**	**2010**	**2011**
TOTAL PRIMARY ENERGY SUPPLY	414.9	408.37	411.73	383.65
Conversion losses	72.43	75.84	79.84	57.35
Energy sector own use	26.38	31.59	30.24	32.04
Gubici transporta i distribucije	9.43	10.29	10.88	10.14
Non-energy use	29.89	25.19	24.97	24.94
FINAL ENERGY CONSUMPTION	276.77	265.46	265.79	259.19
Industry	61.17	51.14	50.3	46.96
Transport	90.47	89.84	86.8	84.97
Other sectors	125.12	124.48	128.7	127.25

Source: Energy in Croatia 2011, Ministry of Economy

According to data from annual energy reports „Energy in Croatia 2008“, „Energy in Croatia 2011“ and „National Action Plan for Renewable Energy Sources by 2020“ (Ministry of Economy, October 2013), it can be seen that electricity generated from renewable energy sources was increased from 155.86 GWh in 2008 to 322.24 GWh in 2011, i.e. more than 2 times. The largest increase is achieved in generation from wind power plants (39.9 GWh in 2008, 201.0 GWh in 2011). Total collected incentive fees for the promotion of the electricity generation from renewable energy sources (RES) amounted 142.98 million HRK in 2008, while 77.9 million HRK in 2011, whereat it should point out that the unit fee rate was reduced from 0.0089 HRK/kWh to 0.005 HRK/kWh. The funds paid to eligible producers amounted 26.2 million HRK in 2008 and 182.2 million HRK in 2011, while in 2012 the funds paid amounted 331.7 million HRK.

In the Republic of Croatia, there are 458 RES fired power plants with total installed capacity of 294.19 MW (as at 30 September 2013) within the incentive system. According to installed capacity, wind power plants are at the first place with total of 254.25 MW, followed by biomass fired power plants (solid biomass and biogas) with total of 14.825 MW and cogeneration power plants with total of 11.49 MW. There are 423 solar power plants with total installed capacity of 9.78 MW. In the next two years, realization of 740 projects with total capacity of 247 MW is expected. Namely, the Croatian Energy Market Operator Ltd. (HROTE) concluded power purchase agreements with 740 generation plants still not connected to the electric power network (as at 30 September 2013). According to the planned capacity, wind power plants are at the first place with total of 150 MW, followed by biomass fired power plants (solid biomass and biogas) with total of 54.96 MW and solar power plants with 37.42 MW. Out of the aforementioned 740 projects, even 720 of them are solar power plants with total capacity of 37.42 MW. It mostly concerns small power plants of up to 30 kW along with some larger plant, but not larger than 300 kW.

The Republic of Croatia promotes biofuel production based on the Act on Biofuels for Transport (OG, 65/2009, 145/2010, 26/2011 and 144/2012). In 2011, the amount of incentive fee for promoting the biofuel production included into diesel and petrol was 0.04 HRK/l. The incentive fee for biofuel production is based on the Decision on Unit Amount of Incentive Fee for Promoting the Biofuel Production in 2011 (OG, 37/2011) and it is indicated in table 2.6-6.

Table 2.6-6: Amount of incentive fee for biofuel production in 2011

Biofuel production	Incentive fee amount in 2011
Biodiesel from vegetable oil, waste cooking oil and lignocellulosic biomass	4.02 HRK/l
Bioethanol from corn, sugar beet and lignocellulosic biomass	1.94 HRK/l

Source: Decision on Unit Amount of Incentive Fee for Promoting the Biofuel Production in 2011

2.7. Transport

Passenger and freight traffic in Croatia is carried out by road, railway transport, sea water and coastal transport, inland waterway transport, air transport and freight transport also via pipelines. Most passengers are transported by road and railway transport (Table 2.7-1), and the most goods by road and sea water and coastal transport (Table 2.7-2). The length of railway lines has not changed since 2006 with a total of 2,722 km of which 2,468 km are single track and 254 km of double track railway. In 2011, a total of 984 km of railway lines were electrified, which amounts to 36% of the total railway length. Number of railway stations and other official places were amounted to 576 in 2011. Railway transport was carried out with 239 locomotives in 2011, of which 40.2% were electric and 59.8% diesel locomotives.

The total length of roads in 2011 was amounted to 29,410 km of which, according to categorisation, there were: 1,254 km of motorways, 6,843 km of state roads, 10,967 km of county roads and 10,346 km of local roads. Road transport is carried out by passenger cars, light duty and heavy duty vehicles, buses, mopeds and motorcycles, and in two cities also by trams. Number of road vehicles is continuously increasing since 1993 and in 2011 was amounted to 1,818,983, of which 81.4% were passenger cars, 6.9% of light duty vehicles, 2% heavy duty vehicles and buses and 9.7% of mopeds and motorcycles. In 1993 there were 140.7 passenger cars per 1,000 inhabitants, and in 2011, that number amounted to 336.2. It should be noted that since 2008 followed the trend of decreasing the number of road vehicles. In the period 2008-2011 the total number of motor vehicles decreased by 4.6%, while the number of passenger cars per 1,000 inhabitants was reduced by 2.7%.

The Republic of Croatia has six ports of international economic interest in the cities: Rijeka, Zadar, Šibenik, Split, Ploče and Dubrovnik. The network of inland waterways of the Republic of Croatian is 804.1 km, of which 539.2 km are international waterways. Inland ports open to international public transport are: Osijek, Sisak, Slavonski Brod and Vukovar. Fleet of national inland waterway carriers in inland waterways is constitute of tug-boats and pusher vessels which in 2009 were amounted to 24 and with a total power of 10,661 kW, and self-propelled barges, self-propelled tanker barges and non-powered cargo vessels which in 2011 were amounted to 50, with a total capacity of 52,992 t.

The Republic of Croatia has 7 international airports: Zagreb, Split, Dubrovnik, Zadar, Osijek, Rijeka and Pula and 3 national airports: Brač, Mali Lošinj and Osijek for aircraft in commercial air transport. In 2011, in the Republic of Croatia, there was 16 aircraft, with a net capacity of 183,020 kg.

Pipeline transport includes transport of oil and gas. The 2011 length of the pipeline amounted to 610 km and has not changed since 2005. The length of the pipeline in 2011 was amounted to 2.410 km and is steadily increasing.

Table 2.7-1: Inland transport of passengers in the Republic of Croatia, by types of transport (′000)

Passengers carried, '000	Railway transport	Road transport	Seawater and coastal transport	Air transport
2008	70,961	62,064	12,861	2,329
2009	73,545	58,493	12,550	2,053
2010	69,564	56,419	12,506	1,861
2011	49,983	52,561	12,926	2,078

Source: Statistical Yearbook 2012

Table 2.7-2: Transport of goods in the Republic of Croatia, by types of transport (′000 t)

Goods carried, '000	Railway transport	Road transport	Seawater and coastal transport	Inland waterway transport	Air transport	Pipeline transport of oil and gas
2008	14,851	110,812	30,768	6,415	5	8,765
2009	11,651	92,847	31,371	5,381	4	9,201
2010	12,203	74,967	31,948	6,928	3	8,936
2011	11,794	74,645	30,348	5,184	3	7,772

Source: Statistical Yearbook 2012

Table 2.7-3: Realized passenger kilometres (mln)

Passenger kilometres	Railway transport	Road transport	Seawater and coastal transport	Air transport
2008	1,810	4,093	491	1,945
2009	1,835	3,438	486	1,636
2010	1,742	3,284	493	1,510
2011	1,486	3,145	583	1,591

Source: Statistical Yearbook 2012

Table 2.7-4: Realized tonne kilometres (mln)

Tonne kilometres	Railway transport	Road transport	Seawater and coastal transport	Inland waterway transport	Air transport	Pipeline transport of oil and gas
2008	3,312	11,042	142,972	843	3	1,677
2009	2,641	9,429	137,345	727	3	1,797
2010	2,618	8,780	162,751	941	2	1,703
2011	2,438	8,926	155,437	692	2	1,477

Source: Statistical Yearbook 2012

2.8. Industry

The structure of the industry in the Republic of Croatia is divided into manufacturing, mining and quarrying and electricity, gas, steam and air conditioning supply. The manufacturing industry in 2010 was covered 82.5%, mining and quarrying 5.67%, and electricity, gas, steam and air conditioning supply 11.81%.[5] Manufacturing industry is along with the sector of financial intermediation, real estate, renting and business services sector, of the economy with the main ingredients in the share of gross domestic product (GDP) and total employment of Croatian and absolutely the largest share in total exports.

[5] Statistical Yearbook 2012

Manufacturing industry, along with Sector of financial intermediation, real estate, renting and business services, contributes most to the structure of the gross domestic product (GDP) and total employment in Croatia, and has absolutely the largest share in total exports[6].

The area of the manufacturing industry (according to National Classification of Activities – NKD 2007.) is divided into:

1. Manufacture of food products
2. Manufacture of beverages
3. Manufacture of tobacco products
4. Manufacture of textiles
5. Manufacture of wearing apparel
6. Manufacture of leather and related products
7. Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
8. Manufacture of paper and paper products
9. Printing and reproduction of recorded media
10. Manufacture of coke and refined petroleum products
11. Manufacture of chemicals and chemical products
12. Manufacture of basic pharmaceutical products and pharmaceutical preparations
13. Manufacture of rubber and plastic products
14. Manufacture of other non-metallic mineral products
15. Manufacture of basic metals
16. Manufacture of fabricated metal products, except machinery and equipment
17. Manufacture of computer, electronic and optical products
18. Manufacture of electrical equipment
19. Manufacture of machinery and equipment n. e. c.
20. Manufacture of motor vehicles, trailers and semi-trailers
21. Manufacture of other transport equipment
22. Manufacture of furniture
23. Other manufacturing
24. Repair and installation of machinery and equipment

Until the recession, industrial production in the Republic of Croatia was covered a significant place in the overall production. Stood out the manufacturing and petrochemical industries and shipbuilding. Some companies were abolished in transition process and some were destroyed during war. Above mentioned, mainly refers to companies that manufacture textiles, leather, metal and wood products. The production in construction and energy sectors was also significant. Some industry still continues to generate positive results and participate in foreign trade. The sale value of industrial products in 2011 amounted to 129.8 billion kuna (17.4 billion euros), of which 49.1 billion kuna (6.6 billion euros) goes to export. According to the total income, the leading industries were production of food, beverages and tobacco products followed by the chemical and petroleum industries. In exports, the most common industry were manufacture of refined petroleum products (11.8 %), motor vehicles (11.2 %), chemical products (8.3 %), food products (8.1 %), electrical equipment (7.8 %), machinery (6.3 %), fabricated metal products (6.1%), pharmaceutical products (4.8 %), wearing apparel (2.9 %), and wood and products of wood (3.4%).

[6] Ministry of Economy

2.9. Waste management

The waste, in accordance with the Sustainable Waste Management Act (OG, 94/2013) means any substance or object which the holder discards or intends or is required to discard. Waste is divided into industrial waste generated in the production processes in industry, trade and other processes, municipal waste generated by household (including any other waste comparable in nature and composition to household waste) also green waste coming from agriculture and forestry.

The waste is managed in a way that it is collected, transported, recovered, disposed and treated in other ways, including the supervision of such operations, and the supervision and after-care of disposal sites, as well as the operations undertaken by dealers or brokers. Implementation and establishment of an integrated waste management system in the Republic of Croatia is enabled by applying and fulfilling the objectives defined in the Sustainable Waste Management Act[7], Strategy[8] and Plan[9].

Waste management is based on the principles of environmental protection laid down by the environmental protection act, the *acquis communautaire* of the European Union, the principles of international environmental law, scientific knowledge, the best global practice and rules of profession, and in particular on the following principles: the polluter-pays principle, the principle of proximity, the principle of self-sufficiency and the principle of traceability.

The Republic of Croatia has established a Waste Management Information System which is used in supervising the implementation and management of the waste management system and is the part of the Environmental Information System which is laid down by the environmental protection act, and maintained by the Environmental Protection Agency.

According to the Report on municipal waste (Environmental Protection Agency, 2011), all cities and municipalities had organized the collection and disposal of municipal waste, while the population covered by organized collection amounted to 96%. In 2011 municipal waste collectors signed by 5 % less municipal waste from households in comparison to 2010, so we can talk about continuing downward trend present since 2008. Total municipal waste produced in 2011 amounted to 1,645,295.0 tonnes. The annual amount of municipal waste per capita was 371 kg and the daily amount per capita of about 1.0 kg. The share of mixed municipal waste (key number 20 03 01) in collected waste accounted for 84%, or 1,377,242.0 tonnes. The share of separately collected types of waste from municipal waste was 16%, which is 2% higher in comparison to 2010. Of the total quantity of wastes collected separately from municipal waste, which amounted to 268,053.0 tonnes, only half is directly addressed to recovery. The share of separately collected biodegradable waste in total produced biodegradable waste was 9.3%, while the share of which was sent to the recovery was 6.2% .

The total amount of waste disposed to landfills in the Republic of Croatia does not meet the objectives laid down in the Sustainable Waste Management Act, and will have to be further reduced. The total amount of waste for disposal by the end of 2013 should not exceed 1.71 million tonnes, so necessary reduction in comparison to 2011 amounts to over 152,000.0 tonnes.

[7] Sustainable Waste Management Act (OG, 94/2013)
[8] Waste Management Strategy of the Republic of Croatia (OG, 130/05)
[9] Waste Management Plan of the Republic of Croatia 2007-2015 (OG, 85/2007)

Amounts of biodegradable municipal waste disposed in 2011 was 937,375 tonnes, according to calculations and estimates of the Environmental Protection Agency, which means that quantity of biodegradable municipal waste is greater for about 370,000.0 tonnes in comparison to defined target (567,131.0 tonnes) of the Sustainable Waste Management Act that need to be fulfilled by the end of the 2013.

2.10. Construction and housing

Buildings in the Republic of Croatia are residential and non-residential buildings. Non-residential buildings include hotels and similar buildings, office buildings, wholesale and retail trade buildings, traffic and communication buildings, industrial buildings and warehouses, public entertainment, education, hospital or institutional care buildings, and other non-residential buildings.

Construction of buildings in the Republic of Croatia had a negative trend in period from 2004 to 2011 (Table 2.10-1). The number of completed residential buildings were decreased by 39.7% during this period. Number of dwellings, however, has continued an upward trend until 2007, when it started the downward trend of 51.6%. The number of completed non-residential buildings were decreased by 42.6%. In the same period the number of completed hotels and similar buildings were most reduced non-residential buildings and were decreased by 65.1% following by wholesale and retail trade buildings by 55.7%.

Table 2.10-1: The number of completed buildings and dwellings

Number of buildings and dwellings	**2008**	**2009**	**2010**	**2011**
Buildings, total	9,923	8,434	7,491	6,777
Residential buildings, total	8,148	6,733	6,108	5,468
Dwellings, total	25,368	18,740	14,972	12,390
Non-residential buildings, total	1,775	1,701	1,383	1,309
Hotels and similar buildings	156	146	128	121
Office buildings	102	82	75	60
Wholesale and retail trade buildings	300	284	197	178
Traffic and communication buildings	243	244	210	181
Industrial buildings and warehouses	356	325	269	269
Public entertainment, education, hospital or institutional care buildings	141	128	89	90
Other non-residential buildings	477	492	415	410

Source: Statistical Yearbook 2012

2.11. Agriculture

Agriculture in the Republic of Croatia, is divided into crop production, livestock production and fishing. Crop production is realized on agricultural land, which includes arable land and gardens, kitchen gardens, orchards, olive groves, vineyards, meadows and pastures, nurseries and land with osier willows. In 2011, utilized agricultural area was 1,326,083 ha, which is 23.4% of the total land area of the Republic of Croatia. Since 2007 the Republic of Croatia has a positive trend in the use of agricultural land with increase of 10.3%. Most represented category in 2011 was the arable land and gardens with 67.3% and permanent grassland with 26.1%, while other categories of utilised agricultural land together constitute 6.6% (Table 2.11-1). Utilisation of arable land and gardens increased by 5.1% in the period from 2007 to 2011, and permanent grassland by

22.12%. On arable land and gardens following types of crops are cultivated: cereals (maize, wheat and barley), dried pulses, root and tuber crops, industrial plants (soy-bean, sugar beet, sunflower, rape seed), vegetables, green fodder from arable land and other arable crops, flowers and ornamental plants, seed crops and seedlings and fallow land.

Table 2.11-1: Utilised agricultural area by categories, ha

Utilised agricultural area, ha	**2008**	**2009**	**2010**	**2011**
Utilised agricultural area, total	12,89,091	12,99,582	1,333,835	1,326,083
Arable land and gardens	855,416	863,023	899,594	892,221
Kitchen gardens	5,337	5,315	4,902	4,233
Permanent grassland (meadows and pastures)	342,430	343,306	345,389	346,403
Orchards	35,933	36,659	32,889	32,560
Vineyards	32,741	34,380	32,709	32,485
Olive groves	14,971	15,304	17,096	17,200
Nurseries	346	579	429	389
Osier willows	917	1,016	827	592

Source: Statistical Yearbook 2012

In the Republic of Croatia 14,107 ha[10] of arable land, or 1.4% of utilized agricultural area were irrigated in 2011. National project of irrigation and agricultural land and water management in the Republic of Croatia (NAPNAV, 2005) has a goal to develop and improve of irrigation infrastructure and to improve management of natural resources.

Livestock number in the Republic of Croatia in the period 2008 - 2011 is shown in Table 2.11-2.

Table 2.11-2: Livestock number, ´000 head

Livestock number, ´000 head	**2008**	**2009**	**2010**	**2011**
Cattle dairy	220	212	182	184
Cattle Non-dairy	234	235	262	262
Sheep	643	619	630	639
Goats	84	76	75	70
Horses	16	17	19	20
Mules/asses	2	2	2	3
Swine	1,104	1,250	1,231	1,233
Poultry	10,015	10,787	9,470	9,523

Source: NIR 2013 (National Inventory Report of the Republic of Croatia for period 1990-2011)

In the Republic of Croatia fishing is divided into maritime and freshwater fishing. Maritime fishing take place in the Croatian sea and freshwater fishing in ponds and open freshwater. The fishing sea of the Republic of Croatia includes external and internal fishing sea, and is divided into 11 fishing zones. Maritime fishing in 2011 were performed with 420 ships, and total size of vessels of 32,300 GT. Total catches in 2011 was amounted to 77,759 tons, of which 85.7% is blue fish and remaining are the other fish, crustaceans and oysters, other molluscs and shellfish. Mariculture includes fish farms for white fish (mostly sea bass and sea bream), blue fish (tuna) and shellfish (mussels, oysters). The total annual production amounts about 7,000 tonnes, of which about 4,000 tonnes is sea bass and sea bream, about 2,000 tonnes of tuna and 400 tonnes of mussels and about 300,000 pieces of oysters.

[10] ARKOD

Freshwater fishing in the Republic of Croatia consists of economic and recreational fishing. Economic fishing is carried out on the Sava and Danube rivers. Freshwater aquaculture involves cold- water and warm-water species, and the most important species are carp, trout, carp (silver and bighead), white amur, sheat-fish, tench, perch and pike. Total production of freshwater fish in 2011 was amounted to approximately 6283 tonnes, of which about 70% is the production of warm-water species, and the remaining part relates to the cultivation of cold-water species. The Republic of Croatia also produce milt, and in 2011 milt production was amounted to 2,555 tons.

2.12. Forestry and terrestrial ecosystems

Pursuant to the Forest Act (OG, 140/2005, 82/2006, 129/2008, 80/2010, 124/2010 and 25/2012), the forests in the Republic of Croatia are classified as continental forests and karst forests. According to their purpose, the forests are classified as commercial forests, protective forests and special purpose forests. Commercial forests are used for timber production, protective forests are used for protection of land, water, settlements, facilities and other goods. The special purpose forests are divided into: forests and parts of forest registered for forest seeds production, forests within protected areas or natural values protected based on the nature protection regulation and forests used for scientific research, teaching, defence requirements of the Republic of Croatia and purposes regulated by special regulations.

The basic principles of forest management are sustainable management with preservation of natural structure and forests diversity, as well as permanent increase of stability and quality of commercial and welfare forest functions. The forest management includes cultivation, protection and usage of forests and forest lands, as well as construction and maintenance of forest infrastructure, pursuant to the pan-European criteria for sustainable forest management. The Forest Act prescribes that by aiming at unique and permanent forest management, a unique forest management area is established in the Republic of Croatia, divided into management units. Forests and forest land in the forest managamenet area[11] in the Republic of Croatia are managed based on the forest management plans: Forest Management Plan of the Republic of Croatia area (so called Management Area), forest management of management units (forest management), karstic management units programmes (management programmes), management programmes for forests owned by private forest owners, forest renewal and protection programmes in especially endangered area, special purpose forest management programmes, annual forest management plans and operational annual plans. The management programmes are approved for the period of 10 years, along with orientation for the next 10 years. At this moment, the management is carried out based on the Forest Management Plan adopted in 2006, enforced from 2006 to 2015. The Forest Management Plan of the Republic of Croatia establishes ecological, economic and social basis for biological improvement of forests and increase of forest production. The management units are managed based on the following plans: *Forest Management of Management Units*, *Karstic Management Units Programme* and *Management Programme for Forests owned by Private Forest Owners*.

The Forest Management Plan in force determines growing stock of about 398 millions of m^3 while its yearly increment amounts about 10.5 millions of m^3. Species' abundance in the total growing stock is as follows: Common beech 36%, Pedunculate oak 13%, Sessile oak 10%,

[11] *forest management area* is a functional unit aiming at sustainable management, planning and directing of forests and forest land development regardless the ownership and divided into management units, Article 5 of the Forest Act (OG, 140/05, 82/06, i 129/08, 80/10, 124/10 and 25/12).

Common hornbeam 9%, Silver fir 9%, Narrow-leafed ash 3%, Spruce 2%, Black alder 2%, Black locust 1%, Turkey oak 1% and other 14%.

In 2010, the First National Forest Inventory of the Republic of Croatia[12] was carried out, initiated in the middle of 2005 based on the Forest Act provisions. Within the inventory project, application CRONFI ANFORRES was developed and tested, representing information system that enables data storage and processing, as well as reporting and state analysis of forest resources. Data collected during forest inventory are not yet available for the purpose of international reporting.

The Republic of Croatia lies at the crossroads of two large phytogeographical regions – the Euro-Siberian-North-American and the Mediterranean, which give the country a great variety of ecosystems, habitat types, and plant and wildlife species. The former includes 78 forest communities of the lowland, hilly, highland, mountain and pre-mountain vegetation belt and the latter 16 thermophilous, evergreen and deciduous forest communities of the Mediterranean coastal and insular Croatia.[13]

In September 2013, the Republic of Croatia Ecological Network became a part of Natura 2000 European Ecological Network[14]. The ecological network is a system of connected or spatially close ecologically important areas. With their balanced biogeographical distribution, they significantly contribute to conserving the natural balance and biodiversity. The areas of the ecological network in the Republic of Croatia are divided into internationally important areas for birds and areas important for other wild taxa and habitat types, while ecological network covers a significant part of Croatian territory, including agricultural and forest areas. The NATURA 2000 Ecological Network covers 36.37% of inland and 16.39%, i.e. 29.38% of the Republic of Croatia area.

For the Republic of Croatia, there are 5,500 taxa (species and sub-species)[15] identified, while the Red Book of Vascular Flora of the Republic of Croatia provides the basic data on Croatia's flora and threats to flora, as well as detailed information on 234 species that are extincted (IUCN[16] categories - EX and RE) or threatened species (CR, EN and VU categories). Besides the aforementioned one, there are seven more red books (cave dvelling fauna, sea fish, dragonflies, fungi, mammals, amphibians and reptiles and freshwater fish) and 17 red lists of threatened taxa.

Pursuant to the Forest Management Plan in force, total forest and forest land area in the Republic of Croatia amounted 2,688,687 ha in 2006, which as regarding total inland area of the Republic of Croatia represents forest cover of 47.5%. Out of total forest area, productive forest land with tree cover amounts 2,402,782 ha (89.4%) and the rest is productive forest land without tree cover (productive, non-productive and unfertile land). In total forest area, 75% of forests is owned by the state, managed by the company Hrvatske šume Ltd., while the remaining 22% are privately owned.

[12] Prof. dr. sc. Juro Čavlović, First National Forest Inventory of the Republic of Croatia, Ministry of Regional Development, Forestry and Water Management and Forestry Faculty of the University in Zagreb, 2010.
[13] Vukelić, Mikac, Baričević, Bakšić, Rosavec: Forest habitats and forest communities in Croatia, State Institute for Nature Protection, Zagreb, 2008.
[14] Regulation on Ecological Network (OG, 124/2013)
[15] Faculty of Science, Biological Department
[16] International Union for Conservation of Nature (IUCN)

In the period from 1997 to the end of 2013, an increase in the area of special purpose forests protected based on the nature protection regulations, compared to the commercial ones, can be noticed. Forest area of 21,967 ha has been protected within the National Parks Risnjak, Plitvička jezera, Mljet and Paklenica. Forests in nature parks belong to commercial forests.[17]

2.13. Inland waters and coastal area

Spatial allocation of surface (rivers, lakes, transitional and coastal waters) and ground waters and their conjuctions are primarily determined by morphological and hydrogeological characterstics of the Croatian area. All waters are part of either Black Sea or Adriatic catchment area with the watershed running along the mountain and alpine area. Large watercourses like Sava, Drava and Danube with many smaller subcatchments dominate the Black Sea catchment area. In the Adriatic catchment area, the abundance and the length of surface watercourses are significantly lower, but there are significant groundwater flows through karst systems. The majority of large watercourses of the Black Sea catchment area is of interstate significance (boundary or cross-border). Among large watercourses in the Republic of Croatia following rivers flow into its cross-border watercourses as well: Sava, Drava and Mura from Slovenia, Danube from Hungary, Una, Vrbas, Ukrina and Bosna from Bosnia and Herzegovina. In the Adriatic catchment area, the boundary river with Slovenia is Dragonja, and the largest cross-border river is Neretva with more than 90% of its catchment situated in Bosnia and Herzegovina. Characteristics of own waters on the Republic of Croatia territory are presented in table 2.13-1.

Table 2.13-1: Characteristics of own waters on the Republic of Croatia territory

Hydrological unit	Black Sea catchment area	Adriatic catchment area	Total
Average precipitation / mm	1001	1426	116
Average evapotranspiration / mm	663	761	700
Average flow-rate / m^3/s	376	451	827
Average specific discharge /l/s/km^2	10.71	21.1	14.6

Source: Water Management Strategy, 2009.

The Black Sea catchment area is more abundant in water if the own and transit waters are taken into consideration; however, own waters of the Adriatic catchment area are much more water abundant per catchment unit. Waters flowing from Bosnia and Herzegovina into the Adriatic catchment area are not transit waters literally because they drain into the Adriatic Sea. Islands are presented as a special unit. According to the average water balance, the Republic of Croatia abounds with water but the interannual distribution of water quantities is not favourable due to the significant spatial and time unequality in water resources distribution. Pursuant to the Water Management Strategy (OG, 91/2008), the basic characteristics of water resources are presented in table 2.13-2.

[17] Ministry of Environmental and Nature Protection, Department for Nature Protection

Table 2.13-2: Basic characteristics of water resources

INDICATOR		Black Sea catchment area	Adriatic catchment area	Croatia
Waters -total	10^9 m^3/year	128.38	27.94	156.32
Water resources – total*	10^9 m^3/year	83.72	27.94	111.66
Water resources – per capita	10^3 m^3/year/capita	27487	20077	25163
Own waters – total	10^9 m^3/year	11.86	14.22	26.08
Own waters – per capita	10^3 m^3/year/capita	3894	10218	5877
Groundwater – total	10^9 m^3/year	2.66	6.47	9.13
Groundwater – per capita	10^3 m^3/year/capita	873	4649	2057
Independency coefficient**		0.142	0.509	0.234
Freedom coefficient***		0.00	1.00	0.25

* Including 50% of the Danube and the Sava waters downstream from the Una mouth

** Independency coefficient – the share of own waters in the renewable water resources

*** Freedom coefficient – the share of waters that do not flow into the territory of other states, i.e. that flow into the Adriatic Sea

River of Danube, the largest and richest in water, flows through the eastern borderland of the Republic of Croatia over a length of 188 km. The rivers of Sava (562 km) and Drava (505 km) have the longest courses in the Republic of Croatia. Kupa is the longest river whose entire course of 296 km flows through the Republic of Croatia. Rivers of the Adriatic catchment area are short, have rapids and canyons. The largest rivers in Istria are Mirna, Dragonja and Raša and in Dalmatia these are Zrmanja, Krka, Cetina and Neretva.

There are not many natural lakes in the Republic of Croatia. The largest natural lakes are Vrana Lake near Pakoštane (30.7 km^2), Prokljan Lake (11.1 km^2), Visovac Lake (7.7 km^2) and Vrana Lake on the island of Cres (5.8 km^2). The most famous Plitvice Lakes are the course of the river Korana transformed into 16 cascade lakes interconnected by travertine downstream beds.

The Republic of Croatia is also characterized by significant wetland areas, especially in flooded parts of Drava, Danube, Sava and Neretva catchments. In 1993, four locations have been included in the Ramsar list: Kopački rit (17,700 ha) in the Drava and Danube cathments, Lonjsko and Mokro polje (50,560 ha) and Crna Mlaka (625 ha) in the Sava catchment and the lower Neretva part (11,500 ha) in the Adriatic catchment.[18] In 2013, Vrana Lake (5,700 ha) was included into the list of internationally significant wetland areas.

The Adriatic Sea is the northernmost part of the Mediterranean Sea. Its salinity is by average 3.83%, which is lower than the eastern Mediterranean Sea but higher than the western.[19] The total length of Croatia's 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 coastal area is separated from the inland with high mountains. 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). Considering the number of islands, islets, cliffs and reefs, the Croatian Adriatic coast is one of the most indented in Europe. The islands are divided into the Istrian, Kvarner, north Adriatic, central Adriatic and south Adriatic group, with the largest islands of Cres (405.78 km^2), Krk (405.78 km^2), Brač (394.57 km^2) and Hvar (299.66 km^2).[20]

[18] State Institute for Nature Protection

[19] Croatian Hydrographic Institute

[20] Statistical Yearbook 2009.

2.14. Other national circumstances - mine suspected areas

Contamination with mines left over from 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. Large agricultural areas, forest areas, border zone and parts of river banks are still inaccessible due to mine contamination or suspicion of mine contamination. Its decisiveness in solving the mine problem, the Republic of Croatia confirmed with the adoption of the Law on Demining in 1996, the establishment of the Croatian Mine Action Centre in 1998, with fulfilling the commitments undertaken by joining the Ottawa Convention, as well as providing for permanent and stable source of funding in the national budget, the World Bank loans and in the legal entities in the Republic of Croatia. The result of all anti-mine action activities since 1991 to the present includes following: suspected hazardous area is precisely defined, suspected hazardous area is significantly reduced, the number of mine incidents and mine victims are continuously reducing. In 2009 the National Mine Action Programme of the Republic of Croatia (OG, 120/2009) that gives, among other things, an overview of the current status of mine suspected area in the Republic of Croatia.

Defined size of mine suspected area in the Republic of Croatia on the 31 December 2008 was amounted to 954.5 km^2, which present 1.69% of the land area of the Republic of Croatian. Mine suspected area encompasses 12 counties or 57% of the total number of counties (21). Mine suspected area covers 111 cities and municipalities or 19.96% of the total number of cities and municipalities in the Republic of Croatia. In the given number of cities and municipalities, live 921,253 inhabitants or 20.78% of the total Croatian population[21]. According to the size of the mine suspected area, the mine most contaminated counties are the County of Lika-Senj, County of Osijek-Baranja, County of Sisak-Moslavina, County of Karlovac, County of Vukovar-Sirmium, County of Zadar and County of Požega-Slavonija.

The largest share in the mine suspected area of the Republic of Croatian consists of forest areas with 557.8 km^2 or 58.4% of total mine suspected area, then agricultural area with 269.2 km^2 or 28.2% of suspected hazardous area, macchia and karst with 109.7 km^2 or 11.5% of suspected hazardous area, yards of inhabited houses with 4.7 km^2 or 0.5% of suspected hazardous areas, infrastructural facilities with 0.2 km^2 or 0.02% of suspected hazardous areas and other areas with 12,9 km^2 or 1.4% of the total suspected hazardous area. The largest number of mines is registered in the County of Osijek-Baranja (30.008), the County of Vukovar-Sirmium (21.444), the County of Lika-Senj (16.103) and the County of Sisak-Moslavina (9.400). Almost 50% the total number of mines (51.452 mines) are placed in the County of Osijek-Baranja and the County of Vukovar-Sirmium.

[21] Source: Census 2001

3. GREENHOUSE GAS INVENTORY INFORMATION, *INCLUDING INFORMATION ON NATIONAL SYSTEM AND NATIONAL REGISTRY*

3.1. Overview of greenhouse gas emission and removal estimates and trends for the period 1990-2011

In this report the results of the greenhouse gas (GHG) emissions and removals calculation are presented for the period from 1990 to 2011.[22] The contribution of individual GHG in the total emission/removal trends for the period 1990-2011 is given in table 3.1-1, while the emission/removal trends in sectors for the period 1990-2011 is given in table 3.1-2.

Table 3.1-1: Emissions/removals of GHG by gases for the period 1990-2011 (Gg CO_2 eq)

Gas	**Emissions and removals of GHG (Gg CO_2 eq)**							
	1990	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
Carbon dioxide (CO_2)	23,339	17,202	20,093	23,485	23,756	21,982	21,289	20,869
Methane (CH_4)	3,466	2,793	2,782	3,182	3,611	3,599	3,639	3,581
Nitrous oxide (N_2O)	3,941	3,054	3,285	3,490	3,570	3,317	3,371	3,485
Hydrofluorocarbons (HFC)	0	49	171	333	424	436	472	476
Perfluorocarbons (PFC)	937	0	0	0	0	0	0	0
Sulphur hexafluoride (SF_6)	11	12	12	14	13	8	9	10
Total emission (excluding net CO_2 from LULUCF)	**31,693**	**23,110**	**26,344**	**30,503**	**31,373**	**29,343**	**28,781**	**28,421**
Removals (LULUCF)	-6,411	-9,079	-7,719	-8,151	-7,824	-8,066	-7,872	-7,032
Total emission (including LULUCF*)*	**25,282**	**14,031**	**18,624**	**22,352**	**23,550**	**21,277**	**20,909**	**21,390**

Table 3.1-2: Emissions/removals of GHG by sectors for the period 1990-2011 (Gg CO_2 eq)

Source	**Emissions and removals of GHG (Gg CO_2 eq)**							
	1990	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
Energy	22,796	17,263	19,482	22,672	22,903	21,651	21,009	20,715
Industrial Processes	3,789	2,016	2,861	3,295	3,592	2,984	3,211	3,000
Solvent and Other Product Use	117	108	109	195	239	153	152	144
Agriculture	4,381	3,055	3,130	3,478	3,581	3,457	3,316	3,442
Waste	611	667	761	864	1,057	1,099	1,092	1,120
Total emission (excluding net CO_2 from LULUCF)	**31,693**	**23,110**	**26,344**	**30,503**	**31,373**	**29,343**	**28,781**	**28,421**
Removals (LULUCF)	-6,411	-9,079	-7,719	-8,151	-7,824	-8,066	-7,872	-7,032
Total emission (including LULUCF*)*	**25,282**	**14,031**	**18,624**	**22,352**	**23,550**	**21,277**	**20,909**	**21,390**

[22] National Inventory Report 2013, Croatian greenhouse gas inventory for the period 1990-2011 (hereinafter: NIR 2013).

3.2. A descriptive summary of the GHG inventory

The GHG inventory NIR 2013 is reported for the period from 1990 to 2011. The NIR 2013 is prepared in accordance with the UNFCCC reporting guidelines on annual Inventories as adopted by the COP by its Decision 18/CP.8. The methodologies used in the calculation of emissions are based on the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines)*, the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC Good Practice Guidance) and the Good Practice Guidance for Land Use, Land-Use Change and Forestry,* prepared by the Intergovernmental Panel on Climate Change (IPCC).

The methodology proposed by the *IPCC Guidelines* is used for the calculation of emissions which are the result of anthropogenic activities and these include the following GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated carbons (HFCs, PFCs) and sulphur hexafluoride (SF_6). As recommended by the *IPCC Guidelines,* country specific methods have been used where appropriate and where they provide more accurate emission data. CORINAIR methodology, proposed by the Convention on Long-range Transboundary Air Pollution (CLRTAP), is used for the emissions calculation of the indirect GHGs: carbon monoxide (CO), oxides of nitrogen (NO_x), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2). The GHGs covered by Montreal Protocol on the pollutants related to ozone depletion (freons) are reported in the framework of this protocol and therefore are included in a separate report.

Since the certain GHGs have different irradiation properties, and consequently different contribution to the greenhouse effect, it is necessary to multiply the emission of every gas with proper Global Warming Potential (GWP), accordingly the 100-year time horizon. In that case the emission of GHGs is presented as the equivalent emission of carbon dioxide (CO_2-eq). If the removal of GHGs occurs (e.g. the absorption of CO_2 at increase of wood stock in forests) than it refers to sinks of GHGs and the amount is presented as a negative value.

GHG emission sources and sinks are divided into six main sectors: Energy, Industrial Processes, Solvent and Other Product Use, Agriculture, Land Use, Land-Use Change and Forestry and Waste. Generally, the methodology for emission calculation could be described as a product of the particular economic activity (e.g. fuel consumption, cement production, number of animals, increase of wood stock etc.) with corresponding emission factors. The use of specific national emission factors is recommended wherever possible and justified, whereas, the methodology gives typical values of emission factors for all relevant activities of the particular sectors.

Trends in GHG emissions

The total GHG emissions in 2011, excluding removals by sinks, amounted to 28,421 Gg CO_2-eq, which represents 10.3 percent emission reduction compared to GHG emission in the year 1990.

Overall decline of economic activities and energy consumption in the period 1991-1994, which was mainly the consequence of the war in Croatia, had directly caused the decline in total emissions of GHGs in that period. Some energy intensive industries reduced their activities or phased out certain productions, which was considerably reflected in GHG emissions reduction. Emissions have started to increase in the 1995 at an average rate of 3 percent per year, till 2008.

Due to decreasing of economic activity within the period 2009-2011, emission has been reduced by 6.4 percent in 2009, 8.0 percent in 2010 and 9.3 percent in 2011, regarding 2008.
The main reasons of GHG emission increase in the period 1995-2008 were in Energy sector (sub-sectors Public electricity and heat production and Transport), Industrial processes (sub-sectors Cement production, Lime production, Ammonia production, Nitric acid production and Consumption of HFCs) and Waste sector (sub-sectors Solid waste disposal on land and Waste water handling).

The main reason of GHG emission decrease in the period 2009-2011 was economic crisis. Namely, because of the economic crisis, there was decrease in industrial production and consequently, decrease in fuel consumption (greatest reduction in fuel consumption was in Manufacturing industries and construction sector and also in Transport sector), as well as a reduction in cement, lime and steel productions, which was contributed to the GHG emission decrease.

The trend of aggregated emissions, divided by gasses, is shown in Figure 3.2-1.

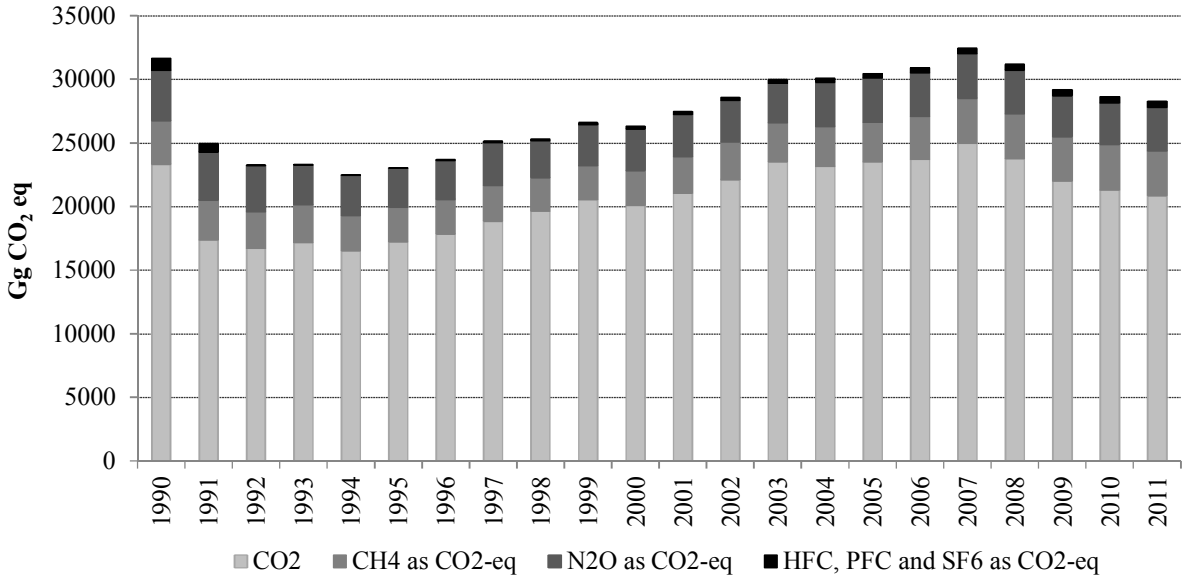

Figure 3.2-1: Trend of GHG emissions, by gases

The shares of GHG emission have not significantly changed during the entire period. In 2011, the shares of GHG emissions were as follows: 73.4 percent CO_2; 12.6 percent CH_4; 12.3 percent N_2O; 1.7 percent HFCs and PFCs and 0.03 percent SF_6.

The trend of aggregated emissions, divided by sectors, is shown in Figure 3.2-2.

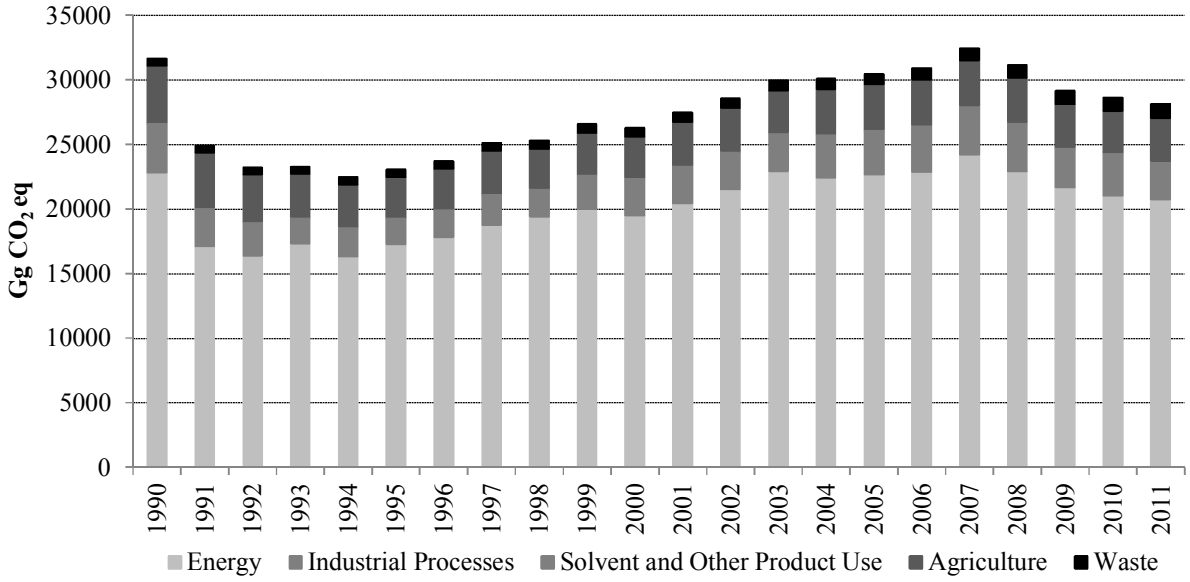

Figure 3.2-2: Trend of GHG emissions, by sectors

The most important IPCC sector in Croatia is Energy sector, which accounted for some 72.9 percent of the total national GHG emissions. In 2011, the GHG emission from Energy was 1.4 percent lower in relation to 2010 and 9.1 percent lower than emission in 1990. The total energy consumption in 2011 was 0.4 percent lower than in the previous year. The consumption of gaseous fuel has decreased (4.5 percent) but consumption of solid fuel has increased for 4.8 percent and also consumption of fuel wood and other renewables has increased (14.8 percent in relation to 2010). In 2011, the total electricity production was 23.2 percent lower than in the former year. Hydro power utilization has decreased by 45.2 percent because of unfavourable hydrological conditions. Increase in energy consumption from thermal power plants, public and industrial cogeneration plants was 31.1 percent. Electricity production in wind power plants was increased for 44.5 percent in relation to 2010. The import of electricity was about 30 percent of total electricity consumption in Croatia.

Industrial Processes contributes to total GHG emission with 10.6 percent in 2011. Due to decreasing of economic activity after 2008, which influenced decreasing of cement, lime and steel productions, in 2011 emissions from this sector have dropped by 16.5 percent, regarding 2008. In 2011, cement production was decreased by 2.6 percent, lime production by 12.9 percent and steel production by 7.3 percent, regarding 2010. On the other hand, in 2011 ammonia production increased by 2 percent, regarding 2010. In 2011 emissions were decreased by 6.6 percent, regarding 2010, and by 20.8 percent, regarding 1990.

Solvent and Other Product Use contributes to total GHG emission with 0.5 percent in 2011. The GHG emission in 2011 was 23.2 percent larger than emission in 1990 since new activity data, regarding sub-sector Other use of solvent, were included in the emission calculation.

Agriculture contributes to total GHG emission with 12.1 percent in 2011. The GHG emissions from Agriculture have been decreasing from 2006 mainly due to the decrease in the number of cattle. The GHG emission in 2011 was 21.4 percent lower in comparison with 1990.

Waste contributes to total GHG emission with 3.9 percent in 2011. Emissions from Waste sector have been constantly increasing in the period 1990-2011 as a consequence of greater quantities of waste, activities in waste water handling and waste incineration. The GHG emission in 2011 was 91 percent larger in comparison with 1990.

Detailed overview of GHG emissions/removals trends by sectors is presented in Annex 1. The following is a summary of the GHG emissions/removals trends by sector.

Carbon dioxide emission (CO_2)

The most significant sources of CO_2 emissions are Energy sector (sub-sectors Electricity or/and heat production and Transport) and Industrial Processes (sub-sectors Cement production and Ammonia production).

CO_2 removals

CO_2 removals occur in the LULUCF sector. Forest land is the category with the largest share of CO_2 removals.

Sectoral and total CO_2 emissions/removals are reported in Table 3.2-1.

Table 3.2-1: CO_2 emissions/removals by sectors for the period 1990-2011 (Gg CO_2)

Source	**1990**	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
Energy	21,234	15,904	18,086	21,061	21,155	19,957	19,252	19,052
Industrial Processes	2,023	1,224	1,933	2,264	2,395	1,906	1,915	1,710
Solvent and Other Product Use	82	74	74	160	205	119	121	107
LULUCF	-6,431	-9,085	-7,784	-8,159	-7,836	-8,076	-7,882	-7,049
Waste	0.04	0.04	0.04	0.03	1.01	0.38	0.13	0.05
Total CO_2 emission (excluding LULUCF)	**23,339**	**17,202**	**20,093**	**23,485**	**23,756**	**21,982**	**21,289**	**20,869**
Total CO_2 emission (including LULUCF)	**16,907**	**8,117**	**12,309**	**15,327**	**15,920**	**13,907**	**13,407**	**13,820**

Methane emission (CH_4)

The major sources of CH_4 emission are Energy sector (sub-sector Fugitive emission from production, processing, transportation and activities related with fuel use), Agriculture (sub-sector Enteric fermentation) and Waste sector (sub-sector Waste Disposal on Land). Sectoral and total CH_4 emissions are reported in Table 3.2-2.

Table 3.2-2: CH_4 emissions by sectors for the period 1990-2011 (Gg CH_4)

Source	1990	1995	2000	2005	2008	2009	2010	2011
Energy	69	61	59	69	78	75	78	74
Industrial Processes	0.7	0.3	0.3	0.2	0.2	0.04	$2*10^{-6}$	$2*10^{-6}$
Agriculture	70	44	41	46	49	49	48	48
LULUCF	0.6	0.1	2.4	0.1	0.2	0.1	0.1	0.3
Waste	25	28	32	36	45	47	47	48
Total CH_4 emission	**166**	**133**	**135**	**152**	**172**	**171**	**173**	**171**

Nitrous oxide emission (N_2O)

The most important sources of N_2O emission are Agriculture (sub-sector Agricultural soils) and Industrial Processes (sub-sector Nitric acid production). Sectoral and total N_2O emissions are reported in Table 3.2-3.

Table 3.2-3: N_2O emissions by sectors for the period 1990-2011 (Gg N_2O)

Source	1990	1995	2000	2005	2008	2009	2010	2011
Energy	0.3	0.2	0.5	0.5	0.4	0.4	0.4	0.3
Industrial Processes	2.6	2.3	2.4	2.2	2.4	2.0	2.6	2.6
Solvent and Other Product Use	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Agriculture	9.4	6.9	7.3	8.1	8.3	7.9	7.4	7.9
LULUCF	0.02	0.01	0.05	0.02	0.03	0.03	0.03	0.03
Waste	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total N_2O emission	**12.7**	**9.9**	**10.6**	**11.3**	**11.5**	**10.7**	**10.9**	**11.3**

Halocarbons (HFCs, PFCs) and SF_6 emissions

Source of HFCs, PFCs and SF_6 emission is Industrial Processes sector (the most important sources are sub-sectors Consumption of halocarbons in refrigeration and air conditioning equipment and Consumption of SF_6 in electrical equipment). Primary aluminium production (the source of significant PFCs emission in 1990) was halted in Croatia in 1992. HFCs, PFCs and SF_6 emissions are reported in Table 3.2-4.

Table 3.2-4: HFCs, PFCs and SF_6 emissions for the period 1990-2011 (Gg CO_2-eq)

Source	1990	1995	2000	2005	2008	2009	2010	2011
Industrial Processes	948	61	183	347	437	444	482	486

Emission of indirect GHGs

Sectoral emissions of indirect GHGs are reported in Table 3.2-5.

Table 3.2-5: Emissions of indirect GHGs by sectors for the period 1990-2011 (Gg)

Gas/source	Emissions (Gg)							
	1990	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
NO_x emission	**69.9**	**61.7**	**69.1**	**75.6**	**53.8**	**47.5**	**43.8**	**42.7**
Energy	65.9	58.4	64.1	65.8	43	39.4	37.1	37.5
Industrial Processes	2.8	2.6	2.8	8.3	9.2	7.0	5.8	4.1
Agriculture	0.8	0.7	0.9	0.9	0.9	0.8	0.8	0.8
LULUCF	0.4	0.1	1.7	0.0	0.1	0.1	0.0	0.2
CO emission	**366.1**	**288.7**	**379.6**	**287.7**	**221.2**	**223.0**	**225.8**	**245.8**
Energy	313.0	258.5	305.4	266.0	198.1	212.4	216.7	232.5
Industrial Processes	41.7	28.4	32.1	19.8	41.8	38.0	12.8	3.4
LULUCF	12.7	1.9	51.5	1.1	3.9	1.9	1.3	6.9
NMVOC emission	**94.0**	**82.8**	**80.4**	**92.1**	**96.9**	**67.3**	**68.2**	**65.0**
Energy	39.7	35.7	42.1	27.6	19	19.3	19.5	20.3
Industrial Processes	24.0	9.3	7.8	8.7	8.3	6.3	5.9	5.3
Solvent and Other Product Use	28.1	25.5	25.3	55.2	64.6	72.1	68.8	40.0
LULUCF	1.3	0.2	5.2	0.1	0.4	0.2	0.1	0.7
SO_2 emission	**173.1**	**82.8**	**62.2**	**63.5**	**51.2**	**53.4**	**40.4**	**37.3**
Energy	170.5	81.2	59.9	61.5	48.8	51.5	39.1	36.1
Industrial Processes	2.6	1.6	2.1	2.1	1.9	2.1	2.4	1.8

3.3. National system under Article 5, Paragraph 1 of the Kyoto Protocol

The preparation and submission of the National Inventory Report (NIR) falls within the competence of the Ministry of Environmental and Nature Protection (MENP). Regulation on the Monitoring of Greenhouse Gas Emissions, Policies and Mitigation Measures in the Republic of Croatia (OG, 87/2012) (hereinafter: Regulation) and Ordinance on Greenhouse Gas Emissions Monitoring in the Republic of Croatia (OG, 134/2012) (hereinafter: Ordinance) prescribe obligation and procedure for emissions monitoring, which comprise estimation and/or reporting of all anthropogenic emissions and removals. Monitoring of GHGs is stipulated by Article 75 of the Air Protection Act (OG, 130/2011) (hereinafter: Act). Institutional arrangement for inventory preparation in Croatia is regulated in Part II of the Regulation entitled National system for the estimation and reporting of anthropogenic greenhouse gas emissions by sources and removals by sinks. Institutional arrangements for inventory preparation in Croatia could be characterized as decentralized and out-sourced with clear tasks breakdown between participating institutions including MENP, Croatian Environment Agency (CEA) 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.

MENP 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 European Union in a manner and within the time limits laid down by legal acts of the European Union;
- control of methodology for GHG emission and removal calculation in line with good practices and national circumstances;
- consideration and approval of the NIR prior to its formal submission to the Convention Secretariat.

CEA is responsible for the following tasks:

- organisation of GHG inventory preparation with the aim of meeting the due deadlines referred to in Article 12 of the Regulation;
- collection of activity data referred to in Article 11 the Regulation;
- 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 (IPCC);
- implementation of the quality assurance procedure with regard to the GHG inventory in line with the QA/QC 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 GHG emissions from sources and removals by sinks, and calculation of indirect GHG emissions, in line with the methodology stipulated by the effective guidelines of the Convention, *IPCC Guidelines*, Instructions for reporting on greenhouse gas emissions as published on the Ministry's website, and on the basis of the activities data referred to in Article 11 of the Regulation;
- quantitative estimate of the calculation uncertainty referred to in indent 1 of this Article for each category of source and removal of GHG emissions, as well as for the inventory as a whole, in line with the *IPCC Guidelines*;
- 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 QA/QC 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 experts review team (ERT) for the purpose of technical review and assessment/evaluation of the inventory submissions.

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 ERT, compilation of inventory including the NIR and the Common Reporting Format (CRF) tables and in parallel implementation of general and source-category specific quality control procedures. Activity data sources for inventory preparation are presented in the Table 3.3-1.

Table 3.3-1: Data sources for GHG inventory preparation

CRF Sector/Sub-sector	**Type of data**	**Source of data**
Energy	Energy balance	- Ministry of Economy 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 - Voluntary survey of Power Utility Company
	Fuel characteristic data	- Voluntary survey of Oil and Gas Company
	Natural gas processed (scrubbed), CO_2 content before scrubbing and CO_2 emission	- Voluntary survey of Central Gas Station
Industrial Processes	Activity data on production/consumption of material for particular industrial process	- Central Bureau of Statistics, Department of Manufacturing and Mining - CEA - 'Republic of Croatia Informative Inventory Report for LRTAP Convention for the Year 2011 Submission to the Convention on Long-range Transboundary Air Pollution'
	Activity data on production/consumption of halogenated hydrocarbons (PFCs, HFCs) and sulphur hexafluoride (SF_6)	- MENP
	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 - CEA
Solvent and Other Product Use	Activity data on production for particular source category and number of inhabitants	- 'Republic of Croatia Informative Inventory Report for LRTAP Convention for the Year 2011 Submission to the Convention on Long-range Transboundary Air Pollution'
Agriculture	Livestock number	- Central Bureau of Statistics - Croatian Horse Breeding Centre - Croatian Agricultural Agency - Ministry of Agriculture – Authority for Veterinary and Food Safety

CRF Sector/Sub-sector	Type of data	Source of data
	Production of N-fixing crops and non N-fixing crops	- Central Bureau of Statistics
	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 cut, fuel wood and wildfires	- Ministry of Agriculture - public company Croatian Forests ("Hrvatske šume")
Waste	Activity data on municipal solid waste disposed to different types of SWDSs	- MENP - CEA
	Activity data on wastewater handling	- State company Croatian Water ("Hrvatske vode")
	Activity data on waste incineration	- CEA

Key categories

According to the *IPCC Good Practice Guidance*, 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. Results of Key categories analysis are presented in Table 3.3-2.

Table 3.3-2: Key categories for Croatia (2011)

IPCC Source Categories	Direct GHG	Criteria for identification of key category			
ENERGY					
Stationary Combustion: Coal	CO_2	L1e	T1e, T2e	L1i	T1i, T2i
Stationary Combustion: Oil	CO_2	L1e, L2e	T1e, T2e	L1i	T1i, T2i
Stationary Combustion: Gas	CO_2	L1e,L2e	T1e,T2e	L1i	T1i, T2i
Mobile Combustion: Road Vehicles	CO_2	L1e, L2e	T1e, T2e	L1i	T1i, T2i
Mobile Combustion: Aircraft	CO_2				T1i, T2i
Combustion: Agriculture/Forestry/Fishing	CO_2	L1e		L1i	T1i, T2i
Fugitive Emissions from Coal Mining and Handling	CH_4				T2i
Fugitive Emissions from Oil and Gas Operations	CH_4	L1e, L2e	T1e	L1i ,L2i	T1i
Fugitive Emissions from Oil and Gas Operations	CO_2	L1e		L1i	
INDUSTRIAL PROCESSES					
Cement Production	CO_2	L1e	T1e, T2e	L1i	
Lime Production	CO_2				T2i
Ammonia Production	CO_2	L1e	T1e, T2e	L1i	
Ferroalloys Production	CO_2		T1e, T2e		T1i, T2i
Aluminium Production	CO_2		T1e, T2e		T1i, T2i
Nitric Acid Production	N_2O	L1e, L2e	T1e, T2e	L1i, L2i	T1i, T2i
HFC and PFC Emissions from Consumption in Refrigeration and Air Conditioning Equipment	HFC/PFC	L1e, L2e	T1e, T2e	L1i, L2i	T1i, T2i
Aluminium production	PFC		T1e, T2e		T1i, T2i
AGRICULTURE					
Enteric Fermentation in Domestic Livestock	CH_4	L1e, L2e	T1e, T2e	L1i	T1i, T2i
Manure Management	N_2O	L1e	T1e, T2e	L1i	T1i, T2i
Direct Emissions from Agricultural Soils	N_2O	L1e, L2e		L1i, L2i	T1i, T2i

Emissions from Pasture Range and Paddock Manure	N_2O	L1e, L2e			T1i, T2i
Indirect Emissions from Nitrogen Used in Agriculture	N_2O	L1e, L2e	T1e	L1i, L2i	T1i, T2i
LULUCF					
Forestland remaining Forestland	CO_2			L1i, L2i	T1i, T2i
Cropland remaining Cropland	CO_2			L2i	T1i, T2i
Land converted to Forestland	CO_2			L2i	T1i, T2i
Land converted to Cropland	CO_2			L2i	
Land Converted to Grassland	CO_2			L2i	
Land converted to Settlements	CO_2			L1i, L2i	T1i, T2i
OTPAD					
Solid Waste Disposal on Land	CH_4	L1e, L2e	T1e, T2e	L1i, L2i	T1i, T2i
Waste Water Handling	CH_4	L1e, L2e		L1i	

Explanation of mark for criteria for identification of key category:

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

Uncertainty assessment

The uncertainties associated with both annual estimates of emissions and emission trends over time are reported according to the *IPCC Good Practice Guidance*. The uncertainties are estimated using Tier 1 and Tier 2 (Monte Carlo analysis) methods described by the IPCC methodology. 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 assessment is one of the essential elements of the national GHG inventory. The information on uncertainty helps both in identifying priority measures to enhance the inventory accurateness and in selecting methodological options. The total estimated uncertainty of emissions from individual sources is a combination of individual uncertainties of emission estimation elements: uncertainty with regard to activity data and uncertainty with regard to emission factors.

General assessment of the completeness

The completeness of inventory is evaluated following the IPCC methodology and appropriate use of the following notation keys: *NO* (not occurred); *NE* (not estimated); *NA* (not applicable); *IE* (included elsewhere); *C* (confidential). Generally, the objective of the completeness is achieved in compliance with the capabilities of the Republic of Croatia in collecting adequate and acceptable activity data. The issues related with lack of activity data are described in sectoral chapters where necessary. The aim of the Croatian inventory is to include all anthropogenic sources of GHGs in the future.

Recalculations

Recalculations are performed using the following categories of distinction:

- changes or refinements in methods;
- correction of errors.

The following methodological changes were made for the emission calculation according to:

- changes in available data;
- consistency with good practice guidance;
- new methods.

Correction of errors mainly refers to typing errors.

Quality assurance and quality control system

Preparation of 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 are conducted to ensure the quality of GHG inventory. 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: QA/QC programme, Quality objectives document, QA/QC plan and Category-specific QC checklist. QA/QC programme describes overall responsibilities and roles of institutions involved in inventory planning, preparation and management, general timetable of activities for data collection, inventory preparation, inventory submission, annual review and reporting on GHG registry and general and specific QA/QC procedures. Quality objectives document defines general and specific short-term (< 1 year) and medium-term (1-3 years) objectives related to the improvement of National system in regard to inventory planning, preparation and management. This document takes into account results of uncertainty analysis, key category analysis and recommendations outlined in the Annual review report. This document is prepared annually.

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, sub-sector and corresponding CRF tables. Finally, before the Authorized Institution submits the NIR to CEA, 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.

Quality assurance activities are accomplished in a way that CEA submits complete NIR and CRF tables to the MENP, which, upon receipt, approves the latter. 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. Members of the National System Committee are nominated by the authorized Ministries upon the request of the MENP. QA/QC coordinator documents all Committee results/findings.

Planned improvements to the inventory

Inventory development process in general encompasses inventory planning, preparation and management and each of these components have to be periodically assessed and improved. Basis for planning of improvements to the inventory are: QA/QC programme, QA/QC plan,

recommendations identified by Committee for inter-sectorial coordination for National system and recommendations identified by the ERT in the course of inventory review process.

Cross-cutting and general planned improvements

In regard to inventory planning phase more attention will be given to the effectiveness of activity data collection particularly in cases when deadlines for submission of activity data by different data providers are not fully met and/or activity data are missing in case higher IPCC methodology tiers are planned to be implemented for emission estimations.

Since inventory preparation is according to national regulation out-sourced to external authorized institution it is critical to follow the timetable established by the regulatory framework and QA/QC programme and Programme for annual activity data collection. In that respect written protocols for activity data submission and adjustments per sectors will be prepared to envisage potential bottlenecks and actions to resolve them. Focus of the protocols will be on providing eligible and robust adjustment techniques, technical corrections and recalculations performed by CEA and/or Authorized Institution if activity data are missing for entire time series and/or data providers are not in position to make such adjustments.

Secondly, Committee for inter-sectorial coordination for National system will perform more active role in streamlining activity data collection according to the agreed timetable, provide recommendations for inventory improvement and in official consideration and approval of the inventory. Still, annual review process carried out by the UNFCCC ERT will continue to be the key driver for changes, prioritization and improvements of the inventory. Since the introduction of annual technical reviews of the national inventories by the ERT, Croatia has undergone in-country reviews in 2004, 2008 and 2012 and centralized reviews in 2005, 2006, 2009, 2010 and 2011. Issues recommended by the ERT have been included in this report as far as possible.

In inventory preparation phase it is decided to strengthen implementation of source-category specific QC procedures (tier 2) for key source categories and to explore possibilities to utilize bottom-up annual GHG emission reports prepared by operators or owners of installations and verified by authorized/accredited bodies which fall under the EU ETS Directive in order to harmonize GHG emissions reported under different monitoring and reporting regimes. If emission calculations prepared by bottom-up installation specific approach (tier 3) could be reconciled with existing tier 1 or tier 2 approach then inventory team will apply higher tier approach. This will be performed in 2014 reporting cycle.

For inventory management, it is decided to improve existing archiving system, particularly Inventory Data Record Sheets (IDRS), by means of developing database solution for archiving information contained in IDRS in order to allow better and more user-friendly search and analysis since amount of data have grown substantially. This will be done in 2014 reporting cycle. Better coordination among stakeholders will be applied in responding to requests for clarifying inventory information resulting from the different stages of the review process of the inventory information, and information on the national system in a timely manner.

Information on changes in National System

National system was changed during the NIR 2013 preparation in part related to legal arrangements where new Regulation was enacted in July 2012 and Ordinance was enacted in December 2012. The purpose of these legal documents is to further harmonize National system

with requirements of EU mechanisms for monitoring and reporting greenhouse gas emissions stipulated by Decisions 2005/166/EC, 406/2009/EC and new Regulation (EU) No 525/2013.

The main improvements are stipulated by the Article 77 of the Act that regulates timeliness and completeness of requirements given for certain tier by prescribing that the state administration bodies and other public bodies competent for activities pertaining to environmental protection, the economy, agriculture, forestry, water management, sea, transport, official statistics, as well as the companies Hrvatske šume d.o.o. (Croatian Forests) and Hrvatska kontrola zračne plovidbe (Croatia Control ltd.), which collect and/or hold data on activities according to sectors, in which GHG emissions are emitted or removed, and which data are required for producing this report should deliver such data to the CEA. The data should be delivered yearly free of charge, taking in consider deadlines prescribed by the Act and the scope and format published by the MENP on its website. Furthermore data required for producing this report should be delivered to the CEA by 30 June of the current year for the previous calendar year. Also, the above mentioned bodies are obligated to participate each year in all phases of data preparation and data submission, report review and revision carried out by the UNFCCC Secretariat.

National Plan for Air Protection, Ozone Layer Protection and Climate Change Mitigation for the period 2013-2017 (OG, 139/2013) stipulates concrete measures to improve performance of National system. It is planned to prepare and carry out two capacity building projects, one related to improvements in emissions estimates in all IPCC sectors and one specifically related to reporting in LULUCF sector.

3.4. National Registry

Croatia has established National GHG emission registry (hereinafter: Registry) as a part of Union Registry in order to ensure accurate accounting of the assigned amount units and to meet the requirements of monitoring, reporting and verification in accordance with Article 7 and 8 of the Protocol. Maintaining the Registry is a requirement for participation in flexible mechanisms of the Kyoto Protocol: joint implementation, clean development mechanism and international emission trading.

Registry is defined by the Regulation as one of the components of the system for monitoring GHG emissions on national level and monitoring the fulfilment of the national annual quota. CEA is responsible for managing the Registry to comply with the requirements of the Protocol.

So far, Croatian Registry made only one transaction; issuance of Assigned Amount Units (AAUs) in February 2012, and had open only national account. The Registry does not open any other accounts, that is, no Emission Reduction Units (ERUs), Certified Emission Reductions (CERs) and Removal Units (RMUs) on the accounts.

Information on changes in the Registry is defined in the NIR 2013.

4. POLICIES AND MEASURES, *INCLUDING THOSE IN ACCORDANCE WITH ARTICLE 2 OF THE KYOTO PROTOCOL, AND DOMESTIC AND REGIONAL PROGRAMMES AND/OR LEGISLATIVE ARRANGEMENTS AND ENFORCEMENT AND ADMINISTRATIVE PROCEDURES*

4.1. The process of adopting policy to mitigate and adapt to climate change

4.1.1. Introduction

Policies and measures for reduction of the emissions and mitigation of the climate change are in the function of fulfilling Croatian international obligations under the Convention, the Kyoto Protocol and the EU acquis and the starting point for long-term development of the economy with low emissions of greenhouse gases. In this context, the priority objective of the Croatia is fulfillment of the obligations under the Kyoto Protocol in reducing the greenhouse gas emissions by 5% in the period 2008-2012 compared to year 1990.

According to current trends and projections it is very likely that Croatia will achieve this goal. Assigned amount units, representing a quota of emissions of Croatian, in the period 2008-2012 amounts to 148,778,503 tonnes CO2-eq while cumulative emissions in the period 2008-2011 totaled 117,918,524 tonnes CO2-eq with constant annual trending downward (final emissions data for the year 2012 shall be determined in the year 2014). With Croatian accession to the European Union, the Republic of Croatia has taken a common European objective of reducing greenhouse gas emissions by 20% by 2020 compared to 1990 with a conditional option to decrease them by 30% if other states take comparable goals, as listed in Annex B of the Kyoto Protocol adopted at the 18th Conference of the Parties to the UNFCCC in Doha, Qatar.

This chapter presents the policy and measures with the direct or indirect objective to reduce greenhouse gas emissions or to increase removal by sinks. In the first part, the general and development policy and the fundamental legislative framework of environmental protection, which regulates the area of mitigation and adaptation to climate change in Croatia are outlined. In the second part, the policy and measures by sectors of influence, the intersectoral policy and relevant project activities were described.

4.1.2. General and Development Policy

The policy and measures for mitigation of climate change cannot be effectively implemented if isolated from the general and development political framework, primarily due to their marked cross-sector impact. The program of the Croatian Government for the mandate 2011-2015 from the December 2011 highlights the importance of economic growth, new investment cycle and the new industrial policy aimed at manufacturing and export-oriented entrepreneurial projects which should boost employment and GDP growth. In parallel, the Croatian government has committed itself to the economic development policy and to a proactive approach to environmental policy as a priority and development policy where will encourage the fight against climate change and the development of technologies which reduce greenhouse gas emissions, such as renewable energy, energy efficiency and sustainable use of natural resources.

A key factor in the implementation of policies and measures to reduce greenhouse gas emissions will be the efficiency of using the EU structural funds and investment funds. As part of the Common Strategic Framework for the funding of programs and projects, the implementation of

policies and measures meets the strategic objectives of the EU, among others, in terms of reducing greenhouse gas emissions, as expressed in the document Europe 2020: A strategy for smart, sustainable and inclusive growth (COM (2010) 2020 final). It should be emphasized that at least 20% of the total EU budget for the period 2014-2020 will be allocated for the implementation of policies, measures and projects related to the mitigation and adaptation to climate change, including the integration of these issues into the other sectoral policies (development, agriculture, cohesion, etc.).

With the accession of the Republic of Croatian to the EU, Croatia has gained the ability to use structural instruments, i.e. the European Regional Development Fund, European Social Fund and the Cohesion Fund. Using funds from the structural instruments is related to the so-called financial perspectives of the EU where financial period lasts seven years with the next period beginning in 2014 and lasts until 2020. A prerequisite for the use of these financial resources is the development of program documents - Partnership Agreement and the Operative Programmes.

Operative Programmes are program documents which aim to determine priority areas in which EU funds will be directed, and will in that way form the basis for the use of structural instruments in the period 2014-2020. By the Decision of the Croatian Government, three Operative Programmes have been established, one of which makes the Operative Programme in the field of competitiveness and cohesion, which will define the activities related to the realization of thematic objectives: supporting convergence to the economy based on low CO2 emissions in all sectors and promotion of the adaptation to climate change, prevention and risk management, environmental protection and efficient use of resources. For the preparation of the operational program Steering Committee and Thematic Working Groups were established for the development of program documents for the financial period 2014-2020 and to draw up proposals for the program documents respectively. The Ministry of Environment and Nature Protection is the lead ministry in the third thematic working group in charge of the above mentioned thematic goals.

Among other strategic and planning documents and the general character of the development, "Strategic options for the development of the green economy", prepared by the former Ministry of Environmental Protection, Physical Planning and Construction, and adopted by the Croatian Government at the meeting held on September 29, 2011, should be emphasized. The purpose of this document is to direct the long-term development of the country towards sustainable development, environmental protection, utilization of natural resources and effective management in all segments of the economy, public and personal needs. In addition to this document, it is important to note the adoption of the Strategy for Sustainable Development of the Republic of Croatia (OG, 30/2009), whose goal is a long-term guiding of the economic and social development and environmental protection towards sustainable development of the Croatian.

With backing from the United Nations Development Programme (UNDP), a development of the framework for the long term low-emission development strategy for Croatia until 2050 has been launched. It through the broad cooperation of stakeholders across sectors (energy, industrial processes, transport, buildings, agriculture, forestry, tourism and waste management) analysed the possible instruments and measures for achieving the long-term goal of reducing the greenhouse gas emissions by 80-95% by 2050 compared to 1990.

4.1.3. Environmental Policy in the Context of Mitigating Climate Change

In the Republic of Croatia executive and legislative bodies participate in the process of adopting and implementing the environmental policy with clearly apportioned responsibilities.

The Ministry of Environmental and Nature Protection has a key role in creating the policy in accordance with the strategic priority objectives of environmental protection and in drafting bills and enforcement regulations. In the previous period a legislative framework was established laying down the principles, objectives and methods of implementing environmental protection in all of its components. It is presently undergoing the process of alignment with the EU legislation. Administrative and specialized activities relating to implementation of measures for climate protection fall within the competence of the Directorate for Environmental Protection and Sustainable Development at MENP's.

The Environmental Protection Act (OG, 80/2013) is the basic law regulating general issues of environmental protection in the Republic of Croatia, which includes: principles of environmental protection within the concept of sustainable development, protection of environmental components and environment from the impacts of loads, environmental subjects, documents on sustainable development and environmental protection, environmental instruments, environmental monitoring and other issues in this regard. This law provides for the preparation of documents for sustainable development and environmental protection as well as laws and regulations in individual areas of influence.

The key document that will determine the long-term goals and guide environmental management in line with the development policy is the Sustainable Development Strategy of the Republic of Croatian that must be made by 2015.

Area of mitigation and adaptation to climate change is regulated by the Air Protection Act which sets competencies and responsibilities to protect the air and the ozone layer, climate change mitigation and adaptation to climate change, planning documents, substances that deplete the ozone layer and fluorinated greenhouse gases, monitoring of greenhouse gas emissions and measures to mitigate and adapt to climate change and funding to protect the air, the ozone layer, climate change mitigation and adaptation to climate change.

The Air Protection Act stipulates the adoption of the subordinated legislation which provide details on specific topics in the areas of mitigation and adaptation to climate change and by which are decisions and decrees of the EU transferred to the national legislation in this field.

Below is an overview of these regulations:

- Regulation on the quality of biofuels (OG, 141/2005, 33/2011),
- Regulation on unit charges, corrective coefficients and detailed criteria and benchmarks for determination of the charge for carbon dioxide emissions into the environment (OG, 73/2007, 48/2009),
- Ordinance on the method and deadlines for calculation and payment of the charge on carbon dioxide emissions into the environment (OG, 77/2007),
- Ordinance on the availability of data on fuel economy and CO2 emissions of new passenger cars (OG, 120/2007),
- Regulation on greenhouse gas emission quotas and the method of emission allowance trading (OG, 142/2008),

- Ordinance on the method of free allocation of emission units to the facilities (OG, 43/2012),
- Regulation on trading with greenhouse gas emission allowances (OG, 69/2012),
- Regulation on the monitoring of greenhouse gas emissions, policies and measures for their reduction in the Republic of Croatia (OG, 87/2012),
- Regulation on substances that deplete the ozone layer and fluorinated greenhouse gases (OG, 92/2012),
- Decision of Auctioneer, for conducting the auction of allowances and the choice of auction system (OG, 124/2012),
- Rules on Greenhouse Gas Emissions Monitoring in the Republic of Croatia (OG, 134/2012),
- Regulations on training of persons engaged in collecting, checking leakages, installation and maintenance or servicing of equipment and devices that contain substances that deplete the ozone layer and fluorinated greenhouse gases or dependents (OG, 3/2013),
- Regulation on the use of the Registry of the European Union (OG, 4/2013),
- Regulation on monitoring, reporting and verification reports on greenhouse gas emissions from the facilities and aircrafts (OG, 8/2013),
- Regulation on monitoring, reporting and verification of the reports on greenhouse gas emissions from the facilities and aircrafts during the period commencing on the January 1, 2013 (OG, 77/2013)
- Regulation on the quality of liquid petroleum fuels (OG, 113/2013).

The main planning document for specific five-year period is The Plan for the Protection of the Air, the Ozone Layer and Climate Change Mitigation in the Republic of Croatia. With it is determined the objectives, priorities and measures for reducing of the greenhouse gas emissions and the way, order, terms and entities for measure implementation. Current active period is from 2013 until 2017 (OG, 139/2013). The measures adopted by this Plan will ensure the implementation of Croatian legislation and the acquis communautaire, which are transferred to the Croatian legislation in the field of protection of the air, the ozone layer and climate change mitigation.

Air Protection Act, along with this plan, prescribes the adoption of other programming, planning and reporting documents, which in the operational terms complement the Plan and involves creation of the following:

- national action plans, national programs and national reports for the purpose of fulfilling the contractual obligations assumed under international treaties in the field of air, ozone layer, mitigation and adaptation to climate change,
- programs to protect air, ozone layer, climate change mitigation and adaptation to climate change for the county, the City of Zagreb and a large cities,
- reports on the state of air quality, reduction of the greenhouse gas emissions and consumption of substances that deplete the ozone layer of the Croatian Republic and for the county, the City of Zagreb and a large cities for a period of four years.

4.2. Sectoral policies and measures

As outlined in the previous chapters, policies and measures for the reduction of the emissions and mitigation of climate change are in the function of the fulfillment of Croatian's international obligations under the Convention, Protocol as well as under "climate-energy" package of EU regulations that have been transferred into the domestic legal system.

With accession to the EU, Croatia has taken a common European objective of reducing the greenhouse gas emission by 20% by 2020 compared to 1990. This common objective is divided into two parts, the first of which includes major sources of greenhouse gases which are liable to the European emissions trading system (EU ETS), and the other so-called non-ETS covers other, relatively smaller, distributed sources of emissions by energy, transport, industrial processes, agriculture and waste management sectors. A special area is a sector of land use, land-use change and forestry. The goal that was set for the EU ETS sector is to reduce emissions by 21% compared to 2005, while for the non-ETS sectors, the total reduction of 10% compared to 2005, but it is differently distributed in the EU countries. The figure 4.2-1 presents the objectives of reducing greenhouse gas emissions in the EU.

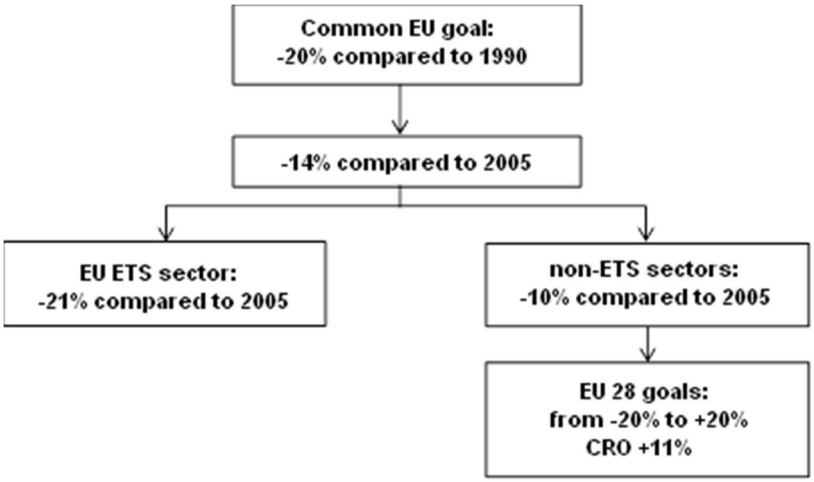

Figure 4.2-1: Goals for greenhouse emission reductions for EU28

Commitments to reduce or limit the increase in emissions for EU members are based on the principle of solidarity. Economically developed countries, whose gross domestic product per capita is higher than the EU average, have committed to reduce emissions by up to 20% (the negative limit), while the less developed countries, including the Republic of Croatia committed to limit the expected increase of emissions up to 20% (the positive limit) relative to the verified emissions from the 2005th year. Positive limit for Croatia from sectors not covered by the emissions trading system is 11% compared to the verified emissions from the 2005th year.

In this regard, for each year of the period 2013-2020, the amount of greenhouse gases emitted from sectors not covered by the emission trading scheme is limited to the amount of annual national quota as determined by Decision 2013/162/EU.

Tables 4.2-1 and 4.2-2 show the national annual quota for the period 2013-2020 for Croatia by the Decision. In the table 4.2-1 national annual quotas are calculated on the basis of the global warming potential of greenhouse gases from the Second Report of the Intergovernmental Committee on Climate Change, while in the Table 4.2-2 same as reported on the basis of the global warming potential of greenhouse gases from the Fourth Assessment Report of the Intergovernmental Committee on Climate Change[23]. The values in Table 4.2-2 will become valid when the Conference of the Parties to the UNFCCC makes a decision on their acceptance.

[23] IPCC Fourth Assessment Report: Climate Change 2007 (AR4), source: www.ipcc.ch

Table 4.2-1: National annual quota for Croatia from the sectors and activities not covered by the emission trading scheme (tonnes of CO2-eq according to the GWP from 1995)

2013.	2014.	2015.	2016.	2017.	2018.	2019.	2020.
20,596,027	20,761,917	20,927,807	21,093,696	21,259,586	21,425,476	21,591,366	21,757,255

Table 4.2-2: National annual quota for Croatia from the sectors and activities not covered by the emission trading scheme (tonnes of CO2-eq according to the GWP from 1997)

2013.	2014.	2015.	2016.	2017.	2018.	2019.	2020.
21,196,005	21,358,410	21,520,815	21,683,221	21,854,626	22,008,031	22,170,436	22,332,841

This chapter gives an overview of the relevant policies and measures in accordance with the foregoing objectives by distributing the ETS sector, including the capture and geological storage of CO2 (CCS) and the non-ETS sector in the involved sectors: energy, transport, industrial processes, agriculture, forestry and waste management. Measures that have cross-sectoral character are particularly mentioned. For consistency, the measures have the nomenclature taken from the Plan for protection of the air, the ozone layer and climate change mitigation in the Republic of Croatia (OG, 139/2013).

4.2.1. Emissions trading system and carbon capture and storage

MSP-1 Inclusion of the plant operators and aircraft operators in the European Union emission trading system (EU ETS) in the full scale from 1 January 2013

From the January 1 2013, the Republic of Croatia has been fully integrated in the EU emission trading system (EU ETS). The EU ETS was developed as a market mechanism for reducing emissions, and was launched in 2005, it includes 27 member states of the European Union and the European Economic Area which are not EU members. Since the beginning of the third period of the EU ETS coincides with the beginning of the calendar year, Croatia was included in the EU ETS even before the formal accession to the European Union on 1 July 2013.

As a preparation for the EU ETS, on January 1, 2010 the monitoring and reporting system of greenhouse gas emissions for the facilities obligated to obtain permits for greenhouse gas emissions was introduced in the Republic of Croatia. It has been prescribed under the applicable Air Protection Act and applicable Regulation on greenhouse gas emission quotas and emission trading. Monitoring and reporting system has been established for the period 2010-2012 and is harmonized with the EU ETS in terms of coverage because it involves the same energy and industrial sectors and the same greenhouse gases as the European system. That way Croatia was already partially introduced in the EU ETS as the monitoring and reporting of emissions are its very important and challenging components. Plant operators in the Republic of Croatia under the existing system secured permits for greenhouse gas emissions and established a regime of reporting of emissions to the competent authority, to which will it be continued in the third period of the EU ETS. The basic difference between the system established in the Republic of Croatia in relation to the EU ETS is that plant operators in Croatia were not obliged to limit emissions to a given threshold as the plant operators in the EU Member States. Since 2013 each facility in the Republic of Croatia covered by the EU ETS will be by the cost of allowances stimulated to reduce emissions from the plants. The year in which the plants in the Republic of Croatia were included in the EU ETS coincides with the beginning of the third trading period, which lasts until 2020. According to the applicable European regulations, emissions trading system will continue upon 2020.

For the proper functioning of the emissions trading system, of vital importance is the proper reporting on emissions, which is ensured by the verification of emission reports from the plants and from the aircrafts. As part of the activities for the implementation of the emissions trading system in the Republic of Croatia, it is necessary to conduct the accreditation of legal entities, which will run for the verification of emission reports. It has hitherto been governed by issuing approvals by MENP's. Accreditation will be carried out in accordance with relevant regulations by the Croatian Accreditation Agency (CAA).

The EU ETS includes activities listed in Annex I of the Regulation on trading with greenhouse gas emissions, of which in the Republic of Croatia, the most represented are the following activities: combustion in power above 20 MW, mineral oil refining, production of pig iron or steel, production of cement clinker, lime production, glass production, production of ceramic products, the production of insulation materials made of mineral wool, production of paper and nitric acid. The system includes greenhouse gases carbon dioxide (CO2) emissions for all activities and additionally for certain activities nitrous oxide (N2O) and perfluorocarbon (PFC). Special activities covered by the EU emissions trading system is the airline industry, included from 2012. This activity includes all flights departing from or with destination in the countries of the European Economic Area. Under the Treaty of accession of the Republic of Croatian to the EU, airline activities for Croatia were included in the system from January 1 of 2014. This will include all flights within the Croatia and flights between the Croatia and countries outside the European Economic Area.

The goal of reducing greenhouse gas emissions from the sectors covered by the EU ETS is aligned with the overall objective of reducing greenhouse gas emissions in the EU compared to emissions in 1990 by 20% by 2020. The goal for fixed facilities is quantified in a way that from 2013 the total number of allowances for allocation at EU level decreases linearly at an annual rate of 1.74%. From the year 2013, aircraft operators are awarded annually with 95% of historical emissions of the average annual emissions in the period 2004 to 2006, which would be included in the trading system since 2012. Reducing the number of available allowances should result in an increase in their market price, which would then be liable to stimulate trading system to invest in technology to reduce greenhouse gas emissions.

MSP-2 Adoption of the Plan for use of funds obtained from the sales of emission allowances through auctions

Emission allowances are allocated to plant operators and aircraft operators in the EU ETS in two ways. One part of the allowances is allocated free of charge under the special rules for which are key historical activity levels and pre-defined benchmarks for industrial products. The remaining part of the allowances is calculated based on the total amount of units specified for the allocation in a particular year of the trading period reduced by the amount of the allowances allocated free of charge in the same year. Units that are not free of charge are allocated through auction, and the total amount of units for auction is allocated to the Member State primarily by the share of emissions of a Member State in total emissions from sectors covered by the trading system at the EU level.

Member State has the right to dispose the funds collected at the auction for the following purposes:

- reduction of greenhouse gas emissions,

- adaptation to climate change,
- financing of measures for mitigation and adaptation to climate change in third countries,
- financing of renewable energy in order to perform the obligation to use 20% renewable energy by 2020,
- improvement of forest resources and reporting in the forestry sector,
- reducing emissions from transport,
- funding research aimed at mitigating climate change and adapting to climate change, including the areas of aeronautics and air transport,
- environmentally safe capture and geological storage of carbon dioxide, particularly from fossil fuel power plants and certain industrial sectors and sub-sectors, including those in third countries,
- encourage the transition to low-emission transport and public forms of transport,
- funding for research and development in energy efficiency and clean technologies,
- funding for research and development in the field of reporting on greenhouse gas emissions,
- measures intended to increase energy efficiency and insulation, or providing financial support to address the social aspects in households with lower and middle incomes.

Funds are deposited to a special account of the Fund for Environmental Protection and Energy Efficiency. The plan for use of the funds is made by the Government of the Republic of Croatia on the proposal of the MENP's. The exception is 5% of the funds from the auction, which will be paid to the state budget of the Republic of Croatian to cover the costs of administering the emissions trading system, for administrative affairs, for the functioning of the Registry of the European Union, for auctioneers, for the National System for monitoring greenhouse gas emissions and for the other activities related to climate changes.

Additional measures in this sector include:

MSP-3 Preparation of The National Feasibility Study with the action plan for the preparatory activities for CCS projects in Croatia

Technology for carbon capture and storage for large emission sources is not yet commercially available. The possibility of commercial application is expected in the period after the 2020.

According to Directive 2009/31/EC on the geological storage of carbon dioxide, respectively Article 36 Directive on industrial emissions 2010/75/EU, for power plants with capacity exceeding 300 MW which have obtained the construction permit after the entry into force of the Directive 2009/31/EK it is necessary to assess whether the following requirements are satisfied:

- suitable storage locations are available,
- transport facilities are technically and economically feasible and
- upgrade of the plant for CO2 capture is technically and economically feasible

If these conditions are satisfied, the competent authority should provide adequate reserve area on the plant's location for equipment for capturing and compressing extracted CO2.

Due to described commitments for new thermal power plants, this measure suggests preparation of The National Feasibility Study with the action plan on the preparatory activities for CCS projects. This Study will include capturing on the sources of emissions, transport, injection and storage.

4.2.2. Energy

Energy policy is the responsibility of the Ministry of Economy, Department of Industrial Policy, Energy and Mining, Ministry of Environment and Nature Protection and the Ministry of Construction and Physical Planning in the area of energy efficiency of buildings. At the implementation level the Fund for Environmental Protection and Energy Efficiency and Agency for Transactions and Mediation in Immovable Properties have a key role in financing the creation, development and implementation of projects in the field of energy efficiency, renewable energy and environmental protection.

The legal framework governing the energy sector in the Republic of Croatia is based on the Energy Act (OG, 120/2012) and the accompanying laws that make energy package:

- The Law on the Regulation of Energy Activities (OG, 120/2012),
- The Electricity Market Act (OG, 22/2013)
- Gas Market Act (OG, 28/2013)
- The Law on the Production, Distribution and Supply of the Thermal Energy (OG, 42/2005, 20/2010),
- Law on Oil and Petroleum Products (OG, 57/2006, 18/2011 and 144/2012),
- Law on Biofuels for Transport (OG, 65/2009, 145/2010, 26/2011 and 144/2012),
- Law on efficient use of energy in final energy consumption (OG, 152/2008, 55/2012),
- Construction Act (OG, 153/2013).

Energy Development Strategy of the Republic of Croatia (OG, 130/2009), as a basic document which sets out energy policy. It sets the following targets for energy efficiency and use of renewable energy sources:

- Energy efficiency in energy production and consumption
  - 10% reduction in final energy consumption by 2020 compared to the average consumption in the period 2001-2005.

- Increasing the share of renewable energy in gross final energy consumption to 20% in 2020, sectoral objectives are as follows:
  - 35% of renewable energy in electricity production, including large hydro (9.2% of the total share of renewable energy sources),
  - 10% in transport (2.2% of the total share of renewable energy sources),
  - 20% for heating and cooling (8.6% of the total share of renewable energy sources).

In accordance with the stated objectives of the Energy Strategy, the following planning documents that define measures to encourage the increase of energy efficiency and measures to encourage the use of renewable energy sources were made:

- The National Energy Efficiency Program for the period 2008-2016,
- The First National Action Plan for Energy Efficiency for the period 2008-2010,
- The National Action Plan for Renewable Energy Sources for the period until 2020,
- The Second National Energy Efficiency Action Plan for the period until 2013.

Energy efficiency

MEN-1 Promotion of energy efficiency in households and services through project activities

The contribution to improving energy efficiency is being achieved through the project "Removing Barriers to Efficient Use of Energy in Households and Services Sector" led by the Ministry of Economy and the United Nations Development Programme (UNDP) with support of Environmental Protection and Energy Efficiency Fund and Global Environmental Fond. The primary objective of the project is to encourage the use of cost-effective, energy efficient (EE) technologies, materials and services in households and the public sector, all in order to reduce unnecessary energy consumption and emission of greenhouse gases into the atmosphere. Project target groups are households, service sector facilities and public facilities responsible for around 40% of the total energy consumption of Croatia. The project should result with raising public awareness, application of measures to public facilities of local administrations of government and cities and support for capacity building of sustainable energy management on local level.

The project is being developed in three major national components:

- Energy Management in Cities and Counties in Croatia (SGE project) Project, which introduces a systematic energy management in cities and counties by encouraging the application of energy efficiency principles for buildings in the local and regional ownership or use.
- Program of the Government House in Order (HiO program), which introduces a systematic energy management in ministries and other government bodies by encouraging the application of the energy efficiency principles in buildings owned and the use of central government.
- Systematically informing and educating citizens, by encouraging the use of energy efficient products, materials and systems at the national and local level, with the encouragement of transformation and sustainable development of EE market.

MEN-2 Energy audits in industry

With this measure, support to assess the potential energy savings in industrial plants through co-financing the implementation of energy audits, should be provided. Scheme for Energy audits in industry includes:

- mandatory energy audits for large consumers (companies with annual energy consumption of more than 10,000 MWh). Obligations is prescribed by the Efficient use of energy in the final energy consumption Low (OG, 152/2008, 55/2012) and Regulation on energy audits and energy certification of buildings (OG, 81/2012),
- voluntary scheme of energy audits for other companies. Energy audits on a voluntary basis will be supported by the financial assistance provided by the Environmental protection and energy efficiency fund.

MEN-3 Measurement and informative calculation of energy consumption

Law on Energy Efficiency in the Final Consumption (OG, 152/2008, 55/2012) stipulates that the operator of distribution system and/or electricity or heat or natural gas supplier have to provide to final customers, for each part of the building that represents an independent entity, the offer of the equipment for measuring energy consumption and billing of energy consumption based on actual energy consumption.

Legible and understandable energy bills (electricity, heat and natural gas) and individual consumption metering, are obligation of distribution system operators and suppliers. This will increase consumer awareness of the way in which they consume energy. Accounts should include comparisons of consumption for the current year and for the corresponding period of the previous year, and information on available energy efficiency measures.

MEN-4 Promotion of the construction of cogeneration

The legislative framework which introduces a system of incentives for the production of electricity from cogeneration was adopted for the implementation of this measure. Regulation on the minimum share of electricity produced from renewable energy sources and cogeneration, whose production is stimulated (OG, 33/2007, 8/2011), as a target by the end of 2020th is set to achieve the share of electricity generation from cogeneration plants, the production of electricity supplied to the transmission and distribution network of 4% of the total final energy consumption. The largest contribution is expected from the new industrial cogeneration.

Incentives (tariffs) are the main mechanism for the promotion of cogeneration. Tariffs are dependent on the installed electric power. In addition to the system, to encourage the production of electricity from cogeneration plants, this measure provides adoption of appropriate regulations to encourage the production of heat from cogeneration (defining the status of privileged heat producer).

MEN-5 Labelling the energy efficiency of household appliances

Scheme of labelling the energy efficiency of household appliancesis is legally prescribed in the Regulations on energy labeling of household appliances (OG, 130/2007, 101/2011). It is prescribed that energy efficiency label have to be marked on all household appliances that use electricity and are placed on the Croatian market, whether they are manufactured in the Republic of Croatia or imported.

With energy labeling customers are informed about the energy consumption of devices, and selection is directed towards more efficient appliances. For the implementation of these measures, a lot has been doing to raise public awareness and educate in order to increase the market share of household appliances with A, A+, A++ energy efficiency class and reduce the market share of household appliances under class C.

MEN-6 Eco-design of energy-using products

With the ordinance on establishing Eco design requirements for energy related products (OG, 80/2013), 2009/125/EZ Directive of the European Parliament and of the Council of 21 the October 2009 about establishing a framework for determining the Eco-design requirements for energy related products is transferred to the Croatian legislation.

With this Ordinance it has been established a framework for the setting of EU Eco-design of energy-related products with the aim of ensuring the free movement of these products in the internal market. The Ordinance provides for the determination of requirements to be met by energy-related products covered by implementing measures, to be placed on the market and / or

in use. It contributes to sustainable development by increasing energy efficiency and the level of environmental protection, while at the same time increasing the security of energy supply.

This ordinance also allows the implementation of the provisions related to the Directive 2009/125/EZ (air conditioners and fans, fan motor-driven, self-circulation pumps without seals, household washing machines, electric motors, non-directional household lamps, lamps directed to the corresponding equipment LED - lamps, fluorescent lamps, external power supplies, cooling devices, simple control boxes, electric and electronic equipment in homes and offices - mode, hold and mute, televisions, household dryers, washing household dishes and pumps water). Regulations came into force on the date of accession of the Republic of Croatian EU.

Renewable energy sources

MEN-7 Supporting the use of renewable energy sources in electricity production

For the implementation of the measures, legislative framework which introduces a system of incentives to produce electricity using renewable energy sources has been adopted. By the Regulation on the minimum share of electricity produced from stimulated production from renewable energy sources and cogeneration (OG, 33/2007, 8/2011) as a target by the end of 2020 is set to achieve the share of electricity production from renewable sources by 13.6 % of the total final consumption of electricity. The largest contribution is expected from the construction of wind power plants, then biomass and biogas power plants, then solar power plants, and a smaller contribution is expected from small hydro and geothermal power plants.

The main mechanisms for the development of renewable energy are incentive prices (tariffs). Rates are dependent on the type of source, plant size and the amount of electricity produced.

MEN-8 Promotion of the construction of cogeneration

The legislative framework which introduces a system of incentives for the production of electricity from cogeneration was adopted for the implementation of this measure. Regulation on the minimum share of electricity produced from renewable energy sources and cogeneration, whose production is stimulated, (OG, 33/2007, 8/2011) as a target by the end of 2020th is set to achieve the share of electricity generation from cogeneration plants, the production of electricity supplied to the transmission and distribution network of 4% of the total final energy consumption. The largest contribution is expected from the new industrial cogeneration.

Incentives (tariffs) are the main mechanism for the promotion of cogeneration. Tariffs are dependent on the installed electric power. In addition to the system, to encourage the production of electricity from cogeneration plants, this measure provides adoption of appropriate regulations to encourage the production of heat from cogeneration (defining the status of privileged heat producer).

MEN-9 Usage of biodegradable fraction of municipal waste in public electricity and heating plants

This is a cross-cutting measure meaning it requires coordination of activities with "Waste management" sector. This measure is related to Production of fuel from waste measure. Among the main objectives defined in the Waste Management Plan of the Republic of Croatia for the

period from 2007th to 2015th (OG, 85/2007, 126/2010, 31/2011) is the reduction of biodegradable waste disposed in municipal solid waste. Using waste as a fuel also means reducing consumption of fossil fuels in the energy sector. One of the activities leading to the accomplishment of this objective is the utilization of waste as alternative fuel in public electricity and heating plants.

MEN-10 Usage of refused derived fuel in the cement industry

The same applies to this measure as to the previous one, but waste is utilized as a fuel of rotary kilns in cement industry. Waste Management Plan defines the technological processes of processing and utilization of municipal waste before final disposal of waste management centres, where procedures of mechanical-biological waste treatment are considered as methods for the production of fuel from waste. Use of fuel from waste results in reduced consumption of primary energy sources. Precondition for implementation of this measure is to ensure a stable quantity, composition and structure of waste.

MEN-11 Promotion of the use of renewable energy sources in heat/cooling energy production

Promoting heating and cooling from renewable energy sources is based on the Production, distribution and supply of thermal energy act (OG, 42/2005, 20/2010). The Act provides preparation of secondary legislation that will define the technology for the production of heat or cooling energy from renewable energy sources, which will determine the minimum annual share of heat and cooling energy to be produced from renewable energy sources, and will determine the form of financial support for a particular technology or renewable energy source.

Measures supporting projects to encourage an increase in energy efficiency and use of renewable energy

MEN-12 Promotion of the use of renewable energy sources and energy efficiency by HBOR-a (Croatian Bank for Reconstruction and Development)

For the purpose of financing environmental protection projects, HBOR extends loans through the Loan programme for the Preparation of Renewable Energy Resources and Loan Programme for the Financing of the Projects of Environmental protection, Energy Efficiency and Renewable Energy Resources.

The goal of the loan program of environmental projects, energy efficiency and renewable energy sources is the realization of investment projects focused on environmental protection, improving energy efficiency and promoting renewable energy. Loans are intended for investment in land, buildings, equipment and devices. Final user may be local and territorial (regional) governments, utility companies, companies, dealers, and other legal entities.

MEN-13 Promotion of the use of renewable energy sources and energy efficiency by FZOEU resources

Environmental Protection and Energy Efficiency Fund provides funding for the preparation, implementation and development of programs and projects in the field of environmental protection, energy efficiency and use of renewable energy sources and climate change mitigation.

Funds for financing are provided from the revenues raised by environmental polluters, which includes fees for nitrogen oxides, sulfur dioxide and carbon dioxide emissions, fees for burdening the environment with waste, environmental user fees and special fees for the environment for motor vehicles.

Resources of the Environmental Protection and Energy Efficiency Fund are allocated to projects which improve energy efficiency, including cogeneration, district heating systems, energy audits and demonstration activities, public lighting projects, fuel replacement and waste heat use and projects in the field of building construction and sustainable building.

Renewable energy projects for which the Environmental Protection and Energy Efficiency Fund dividing resources include solar energy, wind energy, biomass, energy from small hydro and geothermal energy.

Environmental Protection and Energy Efficiency Fund provides grants to local and regional governments, companies, craftsmen, non-profit organizations and individuals, through loans, interest rate subsidies, financial aids and donations.

MEN-14 Energy efficiency projects with implementation through the energy services

Energy efficiency projects with implementation through the energy services include modernization, reconstruction and renovation of existing plants and facilities with the aim of rational use of energy in a way that with savings in energy costs and maintenance will achieve investment return. These projects include the development, implementation and financing to improve energy efficiency and reduce operation and maintenance. Areas of business are public and private sectors, covering buildings (schools and kindergartens, offices, hotels, universities, hospitals), public lighting, industry and energy supply systems (cogeneration, district heating).

4.2.3. Transport

The Ministry of Environment and Nature Protection has drawn up a proposal program of measures to reduce emissions from the transport sector for the period 2013-202. It is based on the second National Action Plan for Energy Efficiency of Croatian for the period until the end of the 2013th and the Energy Strategy of the Republic of Croatian. The program of measures will be co-financed by the Fund.

The plan defines the following existing and additional measures to reduce emissions from transport:

MTR-1 Prescribing limit values for components and characteristics of liquid petroleum fuels

The Regulation on the quality of liquid petroleum fuels (OG, 110/2013) defines limit values for components and characteristics of liquid petroleum fuels including gasoline, diesel fuel, gas oil, fuel oil, marine fuel and kerosene. It also prescribes the method of determining and monitoring the quality of liquid petroleum fuels, attestation of conformity, marking products, and the method and deadline for delivery of reports on the quality of liquid petroleum fuels Environmental Protection Agency.

From the standpoint of the emissions, the most important parameter related to the fuel quality refers to the permitted sulphur content. For diesel and gasoline prescribed limit value for sulphur is 10 mg/kg and applies from January 1, 2011 for gasoline, and from January 1, 2012 for the diesel fuel. Any exemption from the above limit values go to opinion of the European Commission.

For gas oil intended for use in non-road mobile machinery, agricultural and forestry tractors and boats for inland navigation prescribed limit value for sulphur is 10 mg/kg and applied since 1 January 2013. Limit values for sulphur in marine fuels amounts to 1.5% m/m for marine diesel oil (symbol: DMB, DMZ) and 0.1% m/m for marine gas oil (symbol: DMX, DMA) with the proviso that connection ships must use marine fuels with a sulphur content not exceeding 0.1% m/m.

MTR-2 Providing information to consumers on fuel economy and CO2 emission of new passenger cars

Pursuant to the Ordinance on Availability of Information on Fuel Economy and CO2 Emissions from Passenger Cars (OG, 120/07) each supplier of new passenger cars intended for sale shall provide consumers with information on the fuel consumption rate (in litres or cubic meters per 100 km) and specific CO2 emission of passenger cars (in grams per km). Also, the central government body in charge of traffic safety prepares guide on fuel economy and CO2 emissions. Guide is on the website of the Ministry of Interior www.mup.hr.

MTR-3 The implementation of the pilot project and the establishment of the training of drivers of road vehicles for eco-driving

The second National Action Plan for Energy Efficiency of Croatian for the period until the end of 2013, contains measures to improve energy efficiency in transport "Eco-driving Training for Drivers of Road Vehicles."

In order to reduce transportation emissions and encourage energy efficiency as one of the measures has been the Eco-driving. The aim of the pilot project and the establishment of training of drivers of road vehicles for Eco-driving is to achieve the maximum level of awareness of all citizens and the drivers in the Republic of Croatia on the benefits of this modern, intelligent and environmentally friendly driving style.

Specific elements should be devoted to education about eco driving for drivers of passenger cars, buses and trucks.

MTR-4 Promotion of the production and use of biofuels in transport

The basic regulation that regulates and encourages usage of biofuel is Law on Biofuels for Transport (OG, 65/09, 145/10, 26/11, 144/12).

Based on this law, in 2010, The National Action Plan encouraging the production and use of biofuels in transport for the period 2011th - 2020th was designed. Plan establishes a policy to encourage increased production and use of biofuels in transport in Croatia. The plan contains a review and assessment of the situation on the fuel market for transport and air protection,

comparative analysis, long-term goals, including the target-market of biofuels, and measures to encourage increased production and use of biofuels in transport.

Measures prescribed by action plan include measures which encourage the production of raw materials for the production of biofuels, measures which encourage the production of biofuels with reference to fee for encouraging the production, measures which encourage consumption of biofuels with reference to liquid petroleum distributors to place biofuels on the market, and administrative measures and research and development activities.

MTR-5 Modification of the system for special fee payment for the environment for the motor vehicles

The current system of paying a special fee for the environment in motor vehicles is regulated with Environmental Protection and Energy Efficiency Law (OG, 107/03, 144/12), Regulation on unit charges, corrective coefficients and detailed criteria and standards to determine the special environmental fee for motor vehicles (OG, 2/04) and Ordinance on the manner and terms of calculation and payment of the special fee for environment in motor vehicles (OG, 20/04).

Special fee is calculated according to the Regulation, taking into account the type of engine and fuel, engine capacity and age of the vehicle. This measure proposes changes in the method of calculating fees according to which the basic criteria for the calculation will be emissions of pollutants and greenhouse gases which should motivate purchase of vehicles with lower emissions. For the implementation of this measure it is necessary to create a techno-economic analysis with the choice of the optimal solution and the proposed model of calculating fees. Funds raised by paying such a defined fee will be directed to the development of infrastructure for electric and hybrid vehicles and for encouraging their purchase and promotion of the use of vehicles with low emissions.

MTR-6 Financial incentives for the purchase of hybrid and electric vehicles

Electric and hybrid vehicles are currently still more expensive than conventional vehicles with internal combustion engines because of high costs of technological development. Electric vehicles are more efficient than conventional in terms of primary energy consumption and almost neutral in terms of carbon dioxide emissions, if they are powered by electricity generated by using renewable sources. With the aim of increasing the share of electric and hybrid vehicles, introduction of incentive fees and subventions for the purchase of electric and hybrid vehicles through a grant funds is proposed. These fees will be paid from the incomes from Environmental Protection and Energy Efficiency Fund collected from special fee for environment for motor vehicles.

MTR-7 Development of infrastructure for electric vehicles in urban areas

The main objective of this measure is developing and establishing the infrastructure necessary for popularizing the concept of mobility in urban areas and increase the number of electric vehicles in road traffic. Development of infrastructure should be focused on building charging stations and stations for changing electric batteries. Because of the battery capacity, the autonomy of movement and time charging in urban areas is necessary to provide dense network of filing stations vehicles in relation to the distribution of filing stations vehicles with conventional drive. According to experiences in other countries, it was found that for the same

services as for conventional vehicles is necessary to provide one charging station for every four electric vehicles For the implementation of this measure is necessary to prepare a techno-economic analysis with optimal solution and proposed network of filling/battery changing stations.

MTR-8 Development of sustainable transport systems in urban areas

Traffic and the need for mobility is one of the biggest pressures on the environment in urban areas. The increase in the number of passenger cars, the way they are used, the intensity of traffic and unstructured expansion of urban areas largely reversed technological progress in relation to the energy efficiency of vehicles and emission intensity, including noise.

With this measure gradual development of sustainable transport systems in urban areas of Croatia is provided whereas Plan for sustainable transport development should be drawn up as basic documents. That plan will included the analysis of the current situation, definition of the vision and objectives, impact analysis and the adoption of measures for all types of transportation, distribution of responsibilities, method of implementation and monitoring mechanism. That plans would be brought on the level of major cities, and should be prepared in accordance with the European Commission guidelines and funded through EU programs and funds.

4.2.4. Industrial processes

Existing measures for phasing out the use of substances that deplete the ozone layer (controlled and new substances), and measures to reduce emissions of fluorinated gases are regulated by the Regulation on substances that deplete the ozone layer and fluorinated greenhouse gases (OG, 92/2012), adopted under Air Protection Act. The Plan does not prescribe additional measures for these substances.

Controlled substances include: chlorofluorocarbons (CFCs), other fully halogenated chlorofluorocarbons, halons, carbon tetrachloride, 1,1,1-trichloroethane, methyl bromide, hydrobromofluorocarbons (HBFC), hydrochlorofluorocarbons (HCFCs), bromochloromethane and mixtures of controlled substances.

New substances include: dibromo difluoro methane, 1-bromopropane, bromoethane, iodomethane and trifluoro chloromethane.

Fluorinated greenhouse gases include: sulfur hexafluoride (SF6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and mixtures of fluorinated greenhouse gases.

Products and equipment containing controlled substances or which depend on them are related to refrigeration and air conditioners, aerosol cans (except those applied in medicine), solvents, products, systems and fire extinguishers, and polymeric materials.

The products and equipment containing fluorinated greenhouse gases or dependents are other products and equipment (disposable containers, windows, footwear, tires for cars, one-component foams), the non-closed systems with direct evaporation, fire protection systems and fire extinguishers and new aerosols.

The Republic of Croatia, as a party of the Montreal Protocol on substances that deplete the ozone layer, took the responsibility to enforce international and national legislation related to these issues. The Montreal Protocol stipulates measures which regulate the production and consumption of these substances, and sets deadlines for phasing.
By the Decision XXV/16, which was adopted at the 25th summit of the of the Montreal Protocol on Substances that Deplete the Ozone Layer, held in October 2013, the Republic of Croatia has been removed from the list of developing countries that are operating under Article 5 Paragraph 1 of the Montreal Protocol on Substances that Deplete the Ozone Layer. Based on these decisions, the Republic of Croatia now belongs to countries that operate under Article 2 of the Montreal Protocol.

In accordance with the requirements of the Montreal Protocol and the EU Regulation on the substances that deplete the ozone layer and fluorinated greenhouse gases, measures are prescribed for phasing of the controlled and new substances and to reduce emissions of fluorinated greenhouse gases.

These measures can be divided as:

MOS-1 Ban and reduction of consumption of controlled and new substances and fluorinated greenhouse gases

This group of measures for the elimination and reduction of consumption of fluorinated greenhouse gases regulates the production, import, export, release, placing on the market and use of controlled substances, new substances and fluorinated greenhouse gases, as well as equipment and products containing these substances, that depend on them. Measures of this group refer primarily to forbidding these activities, except in specified defined cases.

MOS-2 Technical and organizational measures for collecting, recycling and recovering controlled substances and fluorinated greenhouse gases

This group of measures defines the way in which used controlled substances and fluorinated greenhouse gases contained in products and equipment must be recovered, recycled, reclaimed or destroyed. With these measures the centre's activities for the collection, recycling and recovery of controlled substances and fluorinated greenhouse gases should be determined.

MOS-3 Preventive measures for uncontrolled leaking

With these measures, duties of operators of equipment or systems containing controlled substances and fluorinated greenhouse gases, to take all necessary technically feasible measures to prevent leakage, early eliminate any detected leakage and emissions reduction of these substances into the atmosphere are defined.

4.2.5. Agriculture

MSP-4 Preparation of Study about possibilities of applying measures to reduce greenhouse gas emissions in the agricultural sector

Department of Agriculture participates slightly less than 12% in the total greenhouse gas emissions in Croatia and this share is approximately constant over the entire period since 1990.

Greenhouse gases consist mainly of CH4 and N2O in contrast to other sectors (excluding waste) where the dominant greenhouse gas is CO2.

In agriculture, it is possible to apply the following measures to reduce greenhouse gas emissions:

- changes in regime of feeding cattle and improving the quality of animal feed in order to reduce methane emissions from storage of manure and enteric fermentation,
- anaerobic digestion and biogas production,
- improving the efficiency of nitrogen in agriculture in order to reduce nitrogen dioxide emissions from the application of mineral fertilizers and manure,
- the application of nitrification inhibitors / slow-acting nitrogen fertilizer
- carbon storage in agricultural soils.

The main barriers for the implementation of these measures so far in practice were relatively high investment costs and lack of information about the benefits of these measures to reduce emissions and protect the environment in general. It should also be noted that some of the measures is not yet in commercial use in the EU.

In accordance with the Act on Biofuels for Transport (OG, 65/2009, 145/2010) National Action Plan to encourage the production and use of biofuels in transport for the period 2011-2020 was created. It determines the annual quantitative goals for placement of biofuels on the market and measures to encourage increased production and use of biofuels in transport. The strategic objective of Croatia is to meet national goal for the use of biofuels in transport from domestic production, taking into account the existing production capacity in the Republic of Croatia and the available of raw material for biofuel production (it is assumed that by 2020 in use will be biodiesel, bioethanol and biogas). Assumption is that in the beginning of the period, i.e. until 2017 biodiesel is primarily produced from oil and waste cooking oils and bioethanol from corn and sugar beets. After the commercialization of technologies of production of second generation biofuels, the production of biodiesel and bioethanol from lignocellulosic raw materials after in 2017 is anticipated.

The application of these measures in agriculture carries with it many social and economic risks for farmers whose acceptability in the medium term should be assessed. Accordingly, as the first activity, making of the Study about possible application of measures for reduction of greenhouse gas emissions in the agriculture sector was proposed.

4.2.6. Forestry

MSP-5 Improving the reporting from LULUCF sector

Annex I countries United Nations Framework Convention on Climate Change, including the Croatian, are obligated in accordance with Annex I to Decision 15/CP.17 continuously review the quality of the relevant technical elements of GHG inventory. Because of this commitment, and because of the fact that improvements to the procedure for determining the changes in carbon stocks in LULUCF sector need to be done for each store separately, as well as the procedure for more detailed matrix of land, the implementation of these measures are considered necessary.

Appropriate monitoring needs to be established for all carbon stocks in LULUCF sector. Matrix of land-use change should be monitored through the central exchange of spatial data of the Republic of Croatia.

MSP-6 Preparation of cost-benefit analysis of reforestation on new surfaces and biological regeneration of forests as a measure of increasing sinks in LULUCF sector

Article 3 of the paragraph 3 of the Kyoto Protocol stipulates that the net changes in greenhouse gases emissions and changes in the sources and sinks of greenhouse gases as a result of changes in direct land use caused by human activity and forestry activities, used to fulfil the obligations of Parties included in Annex I of the Kyoto Protocol. They are limited since 1990 to afforestation, reforestation and deforestation, measured as verifiable changes in carbon stocks in each commitment period.

By analysing the costs and benefits of reforestation on the new areas possibility of increasing greenhouse gas sinks using reforestation activities on the barren productive forest floor will be investigated. Thus would justify introduction of possible incentive measures, such as the afforestation of fast-growing species and biological regeneration of forests, equivalent to measures for greenhouse gas emissions reduction.

MSP-7 Revision of reference levels for Forest Management (FMRL) under Article 3.4 of the Kyoto Protocol for the second commitment period

Conference of the Parties to the Kyoto Protocol in Durban, South Africa new rules for the calculation of outflows generated by forest management activities that parties may use for purposes of meeting the greenhouse gas emission reductions in the second commitment period are accepted. The outflow is calculated as the difference between the reference level of forest management activities (the Forest Management Reference Level, FMRL). FMRL for Croatia amounts to -6,289 Mt CO2-eq per year. This means that the parties which achieve greater outflows than those defined by FMRL can count the same as the drain. The limitation is that the overall level of outflows cannot be more than 3.5% of base year emissions. In figures, that means that Croatia can count outflow of up to -1,096 MtCO2e-eq, based on forest management.

Given that the sequence of decisions CMP.7 (Annex 1, Part C, Article 3, Paragraph 4, Item 15 of the Kyoto Protocol) states are obliged to correct the reference level for the *Second commitment period* after the adjustments in the calculation of the national inventory which were result from the application of new methodologies or the use of higher level of calculation. It is expected that this will be the case in Croatia, so it will be necessary to determine a new value for FMRL for Croatia.

MSP-8 Development of Action plan for LULUCF sector

The intention of the EU is to reduce greenhouse gas emissions by 2020 by 20% compared to the 1990, and with the proper conditions even up to 30%.

For now, the LULUCF sector and the outflows in this sector were taken into the account when determining compliance with the commitments to reduce GHG emissions in the EU regarding fulfilment of obligations under the Kyoto Protocol in the First commitment period.

Given that the existing international rules for the calculation of the outflows contained binding and voluntary components, Decision 2/CMP.7 from the 17th Conference of the Parties to the UNFCCC (COP17, in Durban, South Africa) have set rules for reporting LULUCF sector for the purposes of fulfilling obligations under the Second commitment period of the Kyoto Protocol. The European Commission decided therefore to harmonize reporting of LULUCF sector for all its members with decision 2/CMP.7, and in 2012 initiated the process of making a new decision by which will that be regulated. Among other things, the Decision of the European Parliament to the Council no. 529/2013 of 21 May 2013 on the rules for calculation of emissions of the outflows of greenhouse gas emissions resulting from the activities of land use, land-use change forestry and the information related to these activities, the Commission undertook its members to create a so-called LULUCF Action Plan. Member States should define measures to reduce emissions and maintaining or increasing the outflow of the LULUCF sector. Under this proposal, Member States are obliged to draw up an action plan no later than one year from the beginning of the Second commitment period. Republic of Croatia, as a new member of the EU, has the same deadlines for fulfilling the obligations and opportunities of contributions from LULUCF sector. For fulfilling the obligations, Making LULUCF action plan of the Republic of Croatia is a necessity. In the framework of the action plan it will be determined which accumulations of carbon in the wood mass should be exercised in the forestry sector, to enable them to be calculated as the drain, all in relation to the reference value and the use of biomass for energy purposes.

4.2.7. Waste management

MSP-9 Avoiding generation and reducing the quantity of municipal waste

Avoiding waste generation is the main principle of waste management, as outlined in the Law on Waste (OG, 178/04, 111/06, 60/08, 87/09) and the Waste Management Strategy of the Republic of Croatia (OG, 130/05). Waste Management Plan in the Republic of Croatia for the period 2007 – 2015 (OG, 85/07, 126/10) was adopted to meet the objectives of the strategy. This measure should be achieved by cleaner production, education, economic instruments, implementation of regulations on integrated pollution prevention and control and investment in modern technologies.

In 2011, the production of municipal waste was 1,645,295 t. The annual amount of municipal waste production per capita was 371 kg and the daily amount was 1 kg per capita. After the year 2008, there is a decreasing trend of municipal waste, which is largely due to the economic crisis and the very small part a result of measures to avoid, reduce and recycle waste. Of the total amount of municipal waste produced in 2011, about of 91% is sent to landfills. Under the Treaty of Accession of the Republic of Croatia to the EU, quantitative targets and deadlines for reducing the total amount of waste disposed in uncoordinated landfills were defined. By the end of 2013, the maximum permissible weight of waste disposed of at incompatible landfills is 1.71 million tons, by the end of 2014 1.41 million tons, by the end of 2015 1.21 million tons, by the end of 2016 1.01 million tons, by the end of 2017 800,000 tons. Disposal of waste to non-compliant landfills in Croatia is prohibited after December 31, 2017.

MSP-10 Increasing the quantity of sorted and recycled municipal waste

The share of separately collected wastes from municipal waste in the 2011th amounted to 16%, which is 2% higher compared to 2010th year. Of the total quantity of wastes collected separately from municipal waste only half was directly addressed for recovery.

Quantitative targets and deadlines for increasing the amount of separately collected and recycled waste except Waste Management Strategy in Croatia are defined by the Waste Framework Directive. In accordance with the requirements of the Waste Framework Directive by 2015, it is necessary to ensure separate collection of at least paper, metal, plastic and glass. By 2020, it is necessary to ensure the preparation for re-use 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 waste from households, the minimum share of 50% by weight waste.

MSP-11 Increasing the population coverage of organized municipal waste collection system

By including a large number of residents in the organized collection of municipal waste, the amount of waste disposed of at sanitary landfills increases. Quantitative objective of population included in municipal waste collection system is defined by the Waste Management Strategy of the Republic of Croatia. Since 2011, municipal waste collection system covers all cities and municipalities. Extension of municipal waste collection system in 2011 amounted to 96% of the population. The quantitative target for the year 2015 (90%) scheduled by the Waste Management Strategy of Croatia was achieved in 2007. It can be assumed that the coverage of the entire population by municipal waste collection system, which was in the National Waste Management Strategy of Croatia planned by 2025, will be realized earlier.

MSP-12 Methane flaring or using methane as fuel for electricity production

Rehabilitation of landfills, provided environmental and economic feasibility of the project, the landfill should be equipped with the systems for the collection and treatment of landfill gas. The Ordinance on the Modalities and Requirements for Waste Disposal, Categories and Operational Requirements for Landfills (OG, 117/07, 11/2011) stipulates that the landfills where landfill gas is generated shall have the system for collection the gas which shall be processed and used. If the collected landfill gas cannot be used for energy production, it must be flared at the landfill site and the emission of those gases into air has to be prevented. Methane emission into atmosphere is thereby reduced.

Until now one power plant run on landfill gas has been built up with the installed capacity of 2 MW at the Prudinec – Jakuševec landfill site in Zagreb which commenced operation in 2004. In other landfills equipped with systems for the collection and processing, landfill gas is burned in a flare. In 2011th 4,397 tons of methane is processed in landfills, whether it is used to generate electricity or burned in a flare.

MSP-13 Reducing the quantities of disposed biodegradable municipal 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. In 2011, of total biodegradable waste produced, 9.3% of waste were collected separately, and 6.2% were referred for recycling.

Pursuant to the sustainable management of waste, quantitative targets related to the reduction of biodegradable municipal waste going to landfills are established. By the end of 2013, the share of biodegradable municipal waste going to landfills must be reduced to 75% weight of biodegradable municipal waste generated in 1997. By the end of 2016, the share of biodegradable municipal waste going to landfills must be reduced to 50% weight of biodegradable municipal waste produced in 1997 until the end of 2020, the share of biodegradable municipal waste going to landfills must be reduced to 35% weight of biodegradable municipal waste generated in 1997.

Reducing the biodegradable fraction of waste going to the landfills results in reduced emissions of methane, which would otherwise occurred during the process of anaerobic decomposition of waste in landfills.

MSP-14 Production of fuel from waste

The measure is associated with measures *Use of fuel from waste in the production of electricity and heat* and *Use of waste fuels in the cement industry*. Production of fuels from waste by mechanical-biological treatment of municipal waste in regional and county waste management centres is planned. Using biodegradable fraction of waste as fuel to produce electricity and heat as well as in the cement industry is important from the standpoint of reducing greenhouse gas emissions, conservation of primary energy sources and reducing the amount of waste going to landfills. Biodegradable fraction of waste is considered to be neutral with respect to carbon dioxide, and by reducing the amount of biodegradable waste landfilled, reduction of methane emissions will be achieved.

MSP-15 Use of biogas from bioreactors for electricity and heat production

The measure is associated with measures *Encouraging the use of renewable sources in electricity production* and *Encouraging the construction of cogeneration plants*. The main mechanism for promoting implementation of biogas for electricity production and to encourage the construction of biogas cogeneration plants are incentive prices (tariffs) that depend on the installed electric power of the plant. Looking at the waste management sector, the potential reduction in greenhouse gas emissions of these measures is the potential to reduce methane emissions (resulting from the anaerobic decomposition of the biodegradable fraction of waste), which is used to produce electricity and heat.

MSP-16 Thermal treatment of municipal waste and sludge from wastewater treatment

Construction of a facility for thermal processing of municipal waste in the city of Zagreb is planned in which around 300,000 tonnes of municipal waste and around 70,000 tonnes of dried sludge from the "Central waste water treatment plant" would be processed annually at the facility by 2020th. Construction of the plant is related to the issue of reaching the full capacity of the existing municipal waste landfill Prudinec – Jakuševec in Zagreb and disposal of sludge from waste water treatment plants.

The mobile plants are planned to be used for thermal processing of small amounts of municipal and industrial waste (up to 10 t/day). With automatic operation and low operating costs of maintenance, mobile installations occupy a small space, are easy to transport, and are

characterized by the low power consumption. Biodegradable fraction of municipal solid waste and sludge is considered to be neutral with respect to carbon dioxide, and the equivalent amount of energy produced directly reduces carbon dioxide emissions. Indirect methane emission reduction is achieved by reducing the biodegradable fraction of municipal waste going to landfills, which results in in the reduced emissions of methane which would otherwise have occurred during the process of anaerobic decomposition of waste in landfills.

4.2.8. Cross-sectoral measures

MSP-17 Establishing a monitoring, reporting and verification of greenhouse gas emissions in the lifetime of liquid fuels

Directive 2009/30/EC lays down the obligation of monitoring, reporting and verification of greenhouse gas emissions in the lifetime of liquid petroleum fuels including all net emissions of CO2, CH4 and N2O emissions attributable to liquid fuels placed on the domestic market (including blended components) or energy. This includes all relevant stages from extraction or cultivation of culture, including changes in land use, transport and distribution, processing and combustion, irrespective of the place of origin of these emissions. Monitoring and reporting provided by the supplier that puts fuel on the domestic market. Verification report provides accredited entity - Verifier. According to this directive, the supplier was required to gradually reduce greenhouse gas emissions with the order to bring them to the end of 2012 decreased by 10% compared to the reference value in 2010.

The implementation of this measure requires the adoption of a new Regulation on the quality of liquid petroleum fuels and the adoption of a methodology for calculating greenhouse gas emissions in the lifecycle of fuels other than biofuels and energy. And methodology which establishes basic standards for fuel-based greenhouse gas emissions in the lifetime of fossil fuels per unit of energy in 2010, after being brought to the same level to the EU.

MSP-18 CO2 emission tax

The Regulation on Unit Charges, Corrective Coefficients and Detailed Criteria and Benchmarks for Determination of the Charge for Emissions into Environment of Carbon Dioxide (OG, 73/07, 48/09) stipulates the obligation to pay charges on CO2 emission for all stationary sources emitting more than 30 tonnes CO2 per year. Fee payers who invest in energy efficiency, renewable energy and other measures to reduce emissions of CO2 and other greenhouse gas emissions smaller fee is calculated. The Environmental Protection and Energy Efficiency Fund is authorized for accounting and collecting charges.

Money raised from the CO2 charges The Fund uses to finance the development, preparation and implementation of programs and projects of environmental protection, energy efficiency and renewable energy. The "Program of the Fund for Environmental Protection and Energy Efficiency for the period 2010-2012" states that, under the item *Charges for CO2 emissions into the environment* during the period from 2007 to 2009, was collected 161 million Kuna, while in the period 2010-2012 on the same item The Fund plans to raise 179 million Kuna.

From January 1, 2013, 59 plants have been exempt from paying fees on CO2 emissions and are included in the European system for trading greenhouse gas emission allowances. They will pay the funds from auctions to a special account in the Fund, and electricity producers who cover the

emissions from the plant have to buy all allowances via auction. The plants, where emission does not exceed 25,000 t CO2-eq per year and have a rated thermal input below 35 MW may request to be excluded from the trading scheme. Those plants will remain liable to pay a special fee on CO2 emissions, which will be calculated as the difference between verified emissions from the previous year and emissions that corresponds to the amount of allowances to would be allocated to the operator of that facility free of charge, multiplied by the average price of emission allowances at auctions in the previous year.

MSP-19 The establishment of the Committee for cross-sectoral coordination for policies and measures to mitigate and adapt to climate change

According to the Law on Air Protection (OG, 130/11) for monitoring and evaluating the implementation and planning of policies and measures to mitigate and adapt to climate change in Croatia, it is necessary to establish a committee for intersectoral coordination of policies and measures to mitigate and adapt to climate changes. The Committee shall be appointed by representatives of relevant government bodies and other relevant institutions, agencies and non-governmental organizations. The composition of the committee, duties and functioning of the committee determines the Croatian Government on the proposal of the ministry responsible for environmental protection.

MSP-20 Intensifying the use of innovative information and communication technologies (ICT) to reduce greenhouse gas emissions

Innovative information and communication technologies have an increasingly important role in reducing greenhouse gas emissions and increasing energy efficiency. Intensifying their use in public administration, services and manufacturing processes, will boost productivity and work efficiency while reducing energy consumption and consequent greenhouse gas emissions. The measure is expected to intensify the use of innovative ICT and monitoring of actual energy savings and reductions of greenhouse gas emissions.

4.3. Policies and measures that are no longer in use

The measure, which is no longer in the application relates to the payment of fees to the environmental emissions of carbon dioxide for natural and legal persons who within their activities owned or used a single source of carbon dioxide emissions, and who have been issued permits for greenhouse gas emissions in accordance with The Air Protection Act, that is who are liable to the European system of trading greenhouse gas emission allowances.

4.4. The overall review of policies and measures by sector

Table review of policies and measures below gives overview within each sector, and contains a label and name of the measures, the objective of the implementation, the greenhouse gas reduction which is the consequence of the measure, type of the instrument, the status of the implementation and responsibilities for implementing.

Types of the instruments are determined in accordance with the recommendations of the Guidelines for the preparation of national reports in Annex I of the Convention. According to the Guidelines, economic, tax, consensual, regulatory, informational, educational, research, planning and other instruments are distinguished.

Status of implementation can be: applied, adopted or planned. Status "applied" is assigned if the policies and measures have a foothold in the national legislative acts, if they are involved in voluntary agreements, if they are intended for funding of the implementation or if they are engaged with human resources. Status "adopted" is awarded to the policies and measures adopted by the official decision of the government and there is a clear commitment to begin the implementation. For policy options and measures that are still debated, and there is a realistic possibility to adopt and implement the selected status is "planned".

EMISSIONS TRADING SYSTEM

NAME OF MITIGATION ACTION	OBJECTIVE	GREENHOUSE GAS	TYPE OF INSTRUMENT	STATUS	IMPLEMENTING BODY
MSP-1 Inclusion of plant operators and aircraft operators in the European union emission trading system (EU ETS) in the full scale from 1 January 2013 (2013.-2020.)	reduction of greenhouse gas emissions from the industrial sector and the aviation	CO_2, N_2O, PFC	economic, regulatory	implemented	Ministry of Environmental and Nature Protection, Croatian Environmental Agency
MSP-2 Adoption of the Plan for use of funds obtained from the sales of emission allowances through auctions	distribution of funds raised at the auction in projects to mitigate and adapt to climate change	all GHG	economic	adopted	Ministry of Environmental and Nature Protection, Government of Republic of Croatia
MSP-3 Preparation of National feasibility study with the action plan for the preparatory activities for CCS projects in Croatia	preparation of CCS projects in the Republic of Croatia	CO_2	research	planned	Ministry of Economy

AGRICULTURE

NAME OF MITIGATION ACTION	OBJECTIVE	GREENHOUSE GAS	TYPE OF INSTRUMENT	STATUS	IMPLEMENTING BODY
MSP-4 Preparation of Study about possibilities of applying measures to reduce greenhouse gas emissions in the agricultural sector	analysis of possible measures to reduce greenhouse gas emissions from agriculture	CH_4, N_2O	research	planned	Ministry of agriculture, Ministry of Environmental and Nature Protection

FORESTRY

NAME OF MITIGATION ACTION	OBJECTIVE	GREENHOUSE GAS	TYPE OF INSTRUMENT	STATUS	IMPLEMENTING BODY
MSP-5 Improving the reporting from LULUCF sector	improving the quality of data in the LULUCF sector	CO_2	regulatory	planned	Ministry of Environmental and Nature Protection,

					Ministry of agriculture
MSP-6 Preparation of cost-benefit analysis of reforestation on new surfaces and biological regeneration of forests as a measure of increasing sinks in LULUCF sector	examining the justification of new measures to increase the outflow	CO_2	research	planned	Ministry of Environmental and Nature Protection, Ministry of agriculture
MSP-7 Revision of reference levels for Forest Management (FMRL) under Article 3.4 of the Kyoto Protocol for the second commitment period	calculation sinks of greenhouse gases	CO_2	regulatory	planned	Ministry of Environmental and Nature Protection, Ministry of agriculture
MSP-8 Development of Action plan for LULUCF sector	fulfillment of the obligations of submitting data on LULUCF sector European Commission	CO_2	regulatory	planned	Ministry of Environmental and Nature Protection, Ministry of agriculture

WASTE MANAGEMENT

NAME OF MITIGATION ACTION	**OBJECTIVE**	**GREENHOUSE GAS**	**TYPE OF INSTRUMENT**	**STATUS**	**IMPLEMENTING BODY**
MSP-9 Avoiding generation and reducing the quantity of municipal waste	reducing the amount of waste for disposal	CH_4	regulatory, economic	implemented	Units of regional and local self-government
MSP-10 Increasing the quantity of sorted and recycled municipal waste	reducing the amount of waste for disposal	CH_4	regulatory, economic	implemented	Units of regional and local self-government
MSP-11 Increasing the population coverage of organized municipal waste collection system	increase the amount of waste that is managed in a sustainable way	CH_4	regulatory	implemented	Units of regional and local self-government
MSP-12 Methane flaring or using methane as fuel for electricity production	reduce methane emissions into the atmosphere	CO_2, CH_4	regulatory, economic	implemented	Units of regional and local self-government
MSP-13 Reducing the quantities of disposed biodegradable municipal waste	increasing the share of municipal waste treated by mechanical - biological treatment	CH_4	regulatory	adopted	Units of regional and local self-government
MSP-14 Production of fuel from waste	reduce methane emissions into the atmosphere, primary energy savings in energy production and products	CO_2, CH_4	economic	adopted	Units of regional and local self-government
MSP-15 Use of biogas from bioreactors for electricity and heat production	reduce methane emissions into the atmosphere, primary energy savings in energy production	CO_2, CH_4	regulatory, economic	implemented	Units of regional and local self-government
MSP-16 Thermal treatment of municipal waste and sludge from wastewater treatment	replacement of methane greenhouse gas emissions (CO2) lower global warming potential	CO_2, CH_4	economic	planned	City of Zagreb

CROSS-SECTORAL POLICIES AND MEASURES

NAME OF MITIGATION ACTION	OBJECTIVE	GREENHOUSE GAS	TYPE OF INSTRUMENT	STATUS	IMPLEMENTING BODY
MSP-17 Establishing a monitoring, reporting and verification of greenhouse gas emissions in the lifetime of liquid fuels	Greenhouse Gas Emissions Monitoring liquid petroleum fuels	CO_2	regulatory	djelomično adopted	Ministry of Environmental and Nature Protection, Ministry of economy
MSP-18 CO2 emission tax	reduce CO2 emissions from stationary sources with annual emissions greater than 30 tons of CO2, excluding EU ETS operators	CO_2	regulatory, fiscal	implemented	Environmental protection and energy efficiency fund
MSP-19: The establishment of the Committee for cross-sectoral coordination for policies and measures to mitigate and adapt to climate change	monitoring the implementation of policies and measures to mitigate and adapt to climate change	all GHG	regulatory	adopted	Ministry of Environmental and Nature Protection, competent ministries
MSP-20 Intensifying the use of innovative information and communication technologies (ICT) to reduce greenhouse gas emissions	increasing productivity and work efficiency while reducing energy consumption and consequent greenhouse gas emissions. Improve monitoring of GHG emissions	CO_2	information	planned	Ministry of Environmental and Nature Protection, competent ministries, companies

ENERGY

NAME OF MITIGATION ACTION	OBJECTIVE	GREENHOUSE GAS	TYPE OF INSTRUMENT	STATUS	IMPLEMENTING BODY
MEN-1 Promotion of energy efficiency in households and services through project activities	encourage the use of cost effective, energy efficient (EE) technologies, materials and services, households and the public sector	CO_2, CH_4, N_2O	economic, regulatory, information	implemented	Ministry of Economy, The Ministry of Construction and Physical Planning
MEN-2 Energy audits in industry	primary energy savings in energy production	CO_2, CH_4, N_2O	economic, regulatory	implemented	Ministry of Economy
MEN-3 Measurement and informative calculation of energy consumption	primary energy savings in energy production	CO_2, CH_4, N_2O	information	implemented	Ministry of Economy, distributing companies
MEN-4, MEN-8 Promotion of the construction of cogeneration	primary energy savings in electricity production	CO_2, CH_4, N_2O	economic, regulatory	implemented	Ministry of Economy
MEN-5 Labelling the energy efficiency of household appliances	informing consumers about the energy efficiency of household appliances	CO_2, CH_4, N_2O	regulatory, information	implemented	Ministry of Economy

MEN-6 Eco-design of energy-using products	determine the requirements to be met by products associated with energy covered by implementing measures, to be placed on the market and / or put into service	CO_2, CH_4, N_2O	regulatory, information	implemented	Ministry of Economy
MEN-7 Supporting the use of renewable sources in electricity production	increasing the share of renewable energy in gross final energy consumption	CO_2, CH_4, N_2O	economic, regulatory	implemented	Ministry of Economy
MEN-9 Usage of biodegradable fraction of municipal waste in public electricity and heating plants	reducing the consumption of fossil fuels in the energy sector	CO_2, CH_4, N_2O	economic, regulatory	implemented	Ministry of Environmental and Nature Protection
MEN-10 Use of refuse derived fuel in cement industry	primary energy savings in cement production	CO2, CH4, N2O	economic, regulatory	implemented	Ministry of Environmental and Nature Protection
MEN-11 Promotion of the use of renewable energy sources in heat/cooling energy production	increasing the share of renewable energy in gross final energy consumption	CO2, CH4, N2O	economic, regulatory	implemented	Ministry of Economy
MEN-12 Promotion of the use of renewable energy sources and energy efficiency by HBOR-a (Croatian Bank for Reconstruction and Development)	increasing the share of renewable energy in gross final energy consumption, primary energy savings	CO2, CH4, N2O	economic	implemented	HBOR
MEN-13 Promotion of the use of renewable energy sources and energy efficiency by FZOEU resources	increasing the share of renewable energy in gross final energy consumption, primary energy savings	CO2, CH4, N2O	economic	implemented	Environmental protection and energy efficiency fund
MEN-14 Energy efficiency projects with implementation through the energy services	development of energy efficiency projects	CO2, CH4, N2O	economic	implemented	ESCO companies

TRANSPORT

NAME OF MITIGATION ACTION	**OBJECTIVE**	**GREENHOUSE GAS**	**TYPE OF INSTRUMENT**	**STATUS**	**IMPLEMENTING BODY**
MTR-1 Prescribing limit values for components and characteristics of liquid petroleum fuels	reducing CO2 emissions from road vehicles	CO_2	regulatory	implemented	Ministry of Environmental and Nature Protection
MTR-2: Providing information to consumers on fuel economy and CO2 emission of new passenger cars	consumer information on fuel economy and CO2 emissions of new passenger cars	CO2	information	implemented	Ministry of Environmental and Nature Protection
MTR-3: The implementation of the pilot project and the establishment of the training of drivers of road vehicles for eco-driving	reducing CO2 emissions from road vehicles	CO2	educational	planned	Ministry of Interior Affairs, Ministry of Environmental and Nature Protection

MTR-4: Promotion of the production and use of biofuels in transport	increasing the share of biofuels in transport	CO2	regulatory, econimic, fiscal	partially adopted	Ministry of Economy
MTR-5: Modification of the system for special fee payment for the environment for the motor vehicles	reducing CO2 emissions from road vehicles	CO2	fiscal	planned	Ministry of Environmental and Nature Protection, Environmental protection and energy efficiency fund
MTR-6: Financial incentives for the purchase of hybrid and electric vehicles	reducing CO2 emissions from road vehicles	CO2	economic	planned	Ministry of Environmental and Nature Protection, Ministry of Economy
MTR-7: Development of infrastructure for electric vehicles in urban areas	reducing CO2 emissions from road vehicles	CO2	economic	planned	Ministry of Economy, Ministry of maritime affairs, transport and infrastructure
MTR-8: Development of sustainable transport systems in urban areas	reducing CO2 emissions from road vehicles	CO2	research	planned	Ministry of Environmental and Nature Protection, Units of regional and local self-government

INDUSTRIAL PROCESSES

NAME OF MITIGATION ACTION	**OBJECTIVE**	**GREENHOUSE GAS**	**TYPE OF INSTRUMENT**	**STATUS**	**IMPLEMENTING BODY**
MOS-1: Ban and reduction of consumption of controlled and new substances and fluorinated greenhouse gases	ban the use of fluorinated greenhouse gases	SF6, HFC, PFC	regulatory	implemented	Ministry of Environmental and Nature Protection
MOS-2 Technical and organizational measures for collecting, recycling and recovering controlled substances and fluorinated greenhouse gases	recovery of fluorinated greenhouse gases	SF6, HFC, PFC	regulatory	implemented	Centers for collecting, recycling and recovering of fluorinated greenhouse gases
MOS-3: Preventive measures for uncontrolled leaking	prevention of leakage of fluorinated greenhouse gases	SF6, HFC, PFC	regulatory	implemented	Ministry of Environmental and Nature Protection, operators

5. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES, *AND SUPPLEMENTARITY RELATING TO THE KYOTO PROTOCOL MECHANISMS*

5.1. Introduction

This chapter presents the historical greenhouse gas emissions in the period from 1990 to 2012 and projections of greenhouse gas emissions for the period from 2015 to 2030. Emissions have been presented as total emissions of all greenhouse gases reduced to the equivalent CO_2 emissions (Gg CO_2-eq) per sector.

Sectors are identified according to the Guidelines for the preparation of National Communications by Parties included in Annex I to the Convention:

- energy,
- transport,
- industry,
- agriculture,
- forestry,
- waste management.

Particularly the emissions of certain greenhouse gases are presented:

- CO_2,
- CH_4,
- N_2O,
- HFCs and PFCs,
- SF_6.

Projections are presented for three scenarios: the ‘without measures’ scenario, ‘with measures’ scenario and ‘with additional measures’ scenario. Scenario ‘without measures’ assumes that implementation of adopted policies and measures as well as implementation of planned policies and measures, will not happen. Scenario ‘with measures’ assumes a consistent application of policies and measures, which application is already in progress and the application of adopted policies and measures, which application is likely, but still not begun. Scenario ’with additional measures’ is based on the application of planned policies and measures.

Emission projections are based on conditions and projections of macroeconomic parameters from 2010.

5.2. Projections of greenhouse gas emissions by sectors

Policies and measures to reduce emissions from sources and increase sinks of greenhouse gases that are included in the projections, are shown separately by sectors. Within each sector there are measures listed for the ‘without measures', 'with measures' and 'with additional measures' scenarios without presenting the potential to reduce greenhouse gas emissions. The potential for these policies and measures, as quantified effects of their implementation, are presented in chapter 4.

Projections cover the period until the year 2030, with five-year steps. The projections after 2020 are approximate and without detailed analytical background since the preconditions for economic development and other key parameters for this period are within a wide range of uncertainty.

5.2.1. Energetika

The energy sector covers all activities that involve fuel combustion and fugitive emission from fuels from stationary sources. The energy sector is the main cause for anthropogenic emission of greenhouse gases, it accounts approximately 60% of the total greenhouse gases emission.

In the 'without measures' scenario, the emission increases, particularly in the electricity production sub-sector. Reasons for the increase are the increase in energy demands, reduced dependency on electricity imports and the assumption that all new demands for electricity in this scenario are being covered by fossil fuel power plants. In electricity production, the renewable energy sources are at the same level as during 2010, with the production mostly from the existing large hydropower plants. After 2015, liquid fuel will no longer be in use for electricity production. It is also planned that after the year 2020, Croatia will no longer import electricity, which significantly increases the production in Croatian power plants since import amounted to approximately 30%.

Emission in the industry sub-sector is growing with the economic recovery but the growth is moderate, as in other sub-sectors, due to decreasing dependence of energy consumption on the GDP rise and the fact that there is no construction of new energy-intensive industries.

Croatian population is decreasing, and, in this regard, the energy consumption in households, services and agriculture has only a slight upward trend mainly due to increase in standard of energy consumption, which is related to an increase in mobility in passenger traffic. Somewhat more pronounced is the upward trend in energy consumption in the building sector.

The 'with measures' scenario represents a group effect of the measures that are under implementation and adopted with enforcement of existing instruments and measures arising from the transfer of the EU acquis. Measures included in the scenario are:

- cogeneration
    - promotion of the construction of cogeneration,
- renewable energy sources
    - promotion of the use of renewable energy sources for electricity generation,
    - promotion of the use of renewable energy sources for heat generation,
    - promotion of the use of renewable energy sources and energy efficiency through the Croatian Bank for Reconstruction and Development (CBRD),
    - promotion of the use of renewable energy sources and energy efficiency through the Environmental Protection and Energy Efficiency Fund (EPEEF),
- energy efficiency
    - promotion of the use of renewable energy sources and energy efficiency through the Environmental Protection and Energy Efficiency Fund (EPEEF),
    - promotion of the use of renewable energy sources and energy efficiency through the Croatian Bank for Reconstruction and Development (CBRD),
    - HEP ESCO energy efficiency programme,

  - increase of energy efficiency in buildings,
  - energy audits in industry,
  - promotion of energy efficiency in households and services through project activities,
  - household appliance energy efficiency labelling,
  - ecodesign of energy-using products,
- fuel structure change
  - use of refuse derived fuel to generate electricity and heat,
  - use of refuse derived fuel in cement industry,
- revitalization of nuclear power plant Krško/extend lifetime up to year 2030.

The 'with additional measures' scenario is based on the application of the above 'with measures' scenario and shows the effect of additional measures that are planned:

- installations for the capture and geological storage of CO_2 (CCS) in new coal-fired and gas-fired power plants larger than 300 MWe after the year 2025,
- implementation of CO_2 injection technology for enhanced oil recovery (EOR).

Historical and projected trends in greenhouse gas emissions from energy sector are presented in Figure 5.2-1.

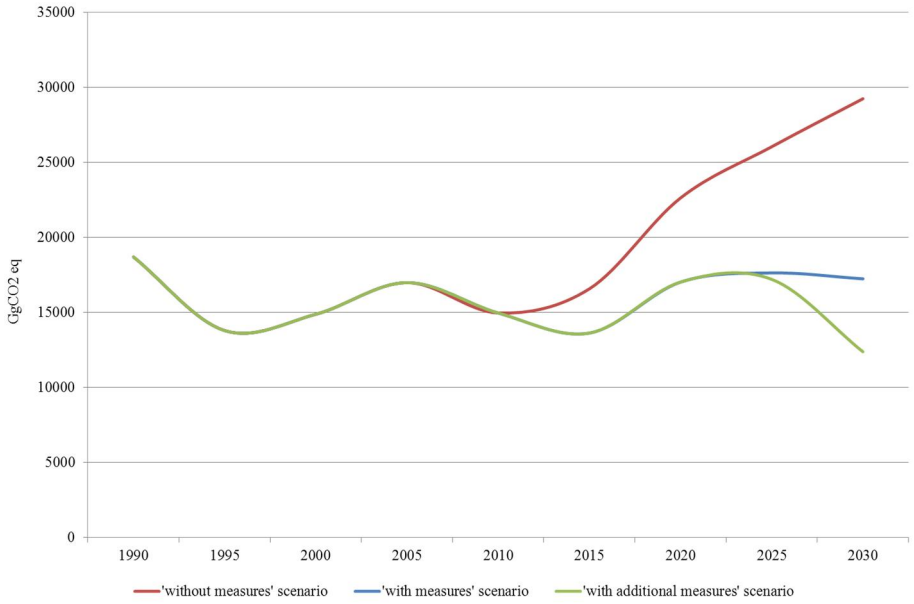

Figure 5.2-1: Historical and projected greenhouse gas emissions from energy sector

Projections show a decline in emissions until the year 2015 due to the economic and financial crisis. A sudden increase in emissions after 2015 is expected to occur primarily due to the strengthening of economic activity and the consequent increase in energy demands, with the reducing dependence on imported electricity. Stagnation of the increase in emissions is expected after the year 2020 in 'with measures' scenario and decrease in emissions in 'with additional measures' scenario.

5.2.2. Transport

The transport sector includes emissions from fuel combustion in road transportation, civil aviation, railways and navigation, and makes about 20% of total Croatia's greenhouse gases emission.

The 'without measures' scenario implies a development of final energy consumption in line with market trends and consumers' habits, without government interventions, but assuming the usual application of new, technologically advanced products that over time appear on the market.

The 'with measures' scenario includes measures to reduce greenhouse gas emissions arising from existing regulations and the transfer of the EU acquis:

- energy efficiency
  - introducing the obligation to provide information on fuel economy and CO_2 emissions of new cars,
  - increasing the efficiency of new cars, which includes a significant proportion of hybrid vehicles,
- renewable energy sources
  - obligation to place biofuels on the Croatian market,
  - obligation to purchase or lease vehicles that can use biofuels in public transport and the public sector,
  - encouraging the production of biofuels,
- electric vehicles
  - financial incentives for the purchase of hybrid and electric vehicles,
  - development of infrastructure for electric vehicles in urban areas,
  - development of sustainable transport systems in urban areas,

The 'with additional measures' scenario assumes the following measures:

- energy efficiency
- stronger penetration of low-energy consumption vehicles and electric vehicles,
- renewable energy sources
- stronger encourage the use of biofuels,
- change of vehicle structure and fuel for cars
- enhancing the attractiveness of rail transport,
- the use of inland waterway transport,
- encourage the use of bicycles.

Historical and projected trends in greenhouse gas emissions from transport sector are presented in Figure 5.2-2.

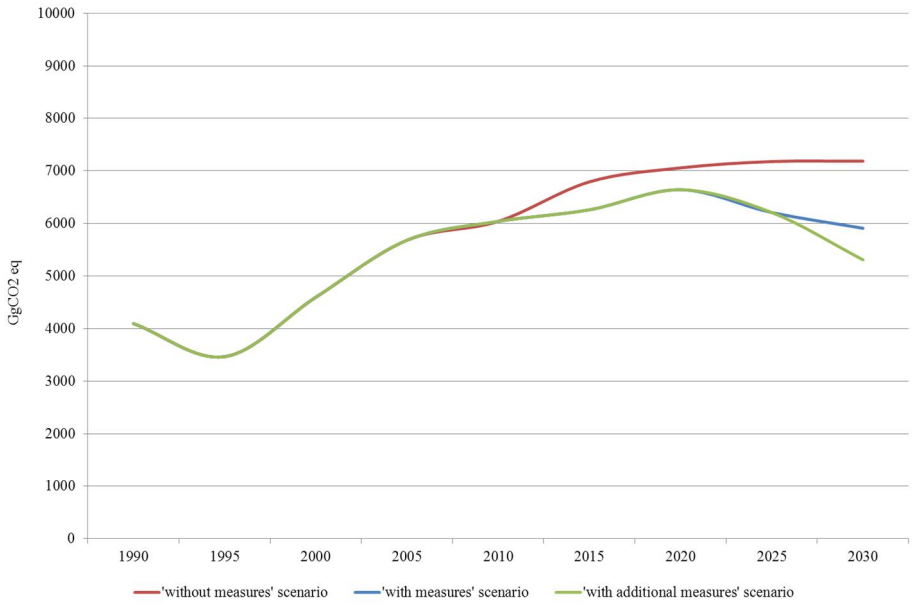

Figure 5.2-2: Historical and projected greenhouse gas emissions from transport sector

The projections indicate a significant emission increase in period until 2020. After 2020, it is expected an emission decrease in 'with measures' scenario and 'with additional measures' scenario.

5.2.3. Industry

The industry sector includes the process emission, while emission from fuel combustion in industry is included into energy sector.

Industry sector contributes to the total greenhouse gases emission with about 10%, of which 96% comes from the key sources of emissions: production of cement, lime, nitric acid, ammonia and the consumption of hydrofluorocarbons in refrigerating and air-conditioning equipment. Solvent use sector, which is observed within the framework of industry sector, contributes to the total greenhouse gas emission with about 1%.

The 'without measures' scenario assumes that production in industrial processes will reach planned, maximum values until 2030.

The 'with measures' scenario includes appliance of cost-efficient greenhouse gas emission reduction measures in production of cement and nitric acid as well as solvent use. The scenario includes the following measures:

- reducing the clinker factor in cement production,
- N_2O emission reduction in nitric acid production (non-selective catalytic reduction),
- reduction of volatile organic compounds emission in solvent use sector.

The measures: reducing the clinker factor in cement production and N_2O emission reduction in nitric acid production are included in measure MSP-1 Inclusion of the operators and aircraft

operators in the European union emission trading system (EU ETS) in the full scale from 1 January 2013.

Scenario comprises process emission. Emission from fuel combustion is included in the energy sector.

Historical and projected trends in greenhouse gas emissions from industry sector are presented in Figure 5.2-3.

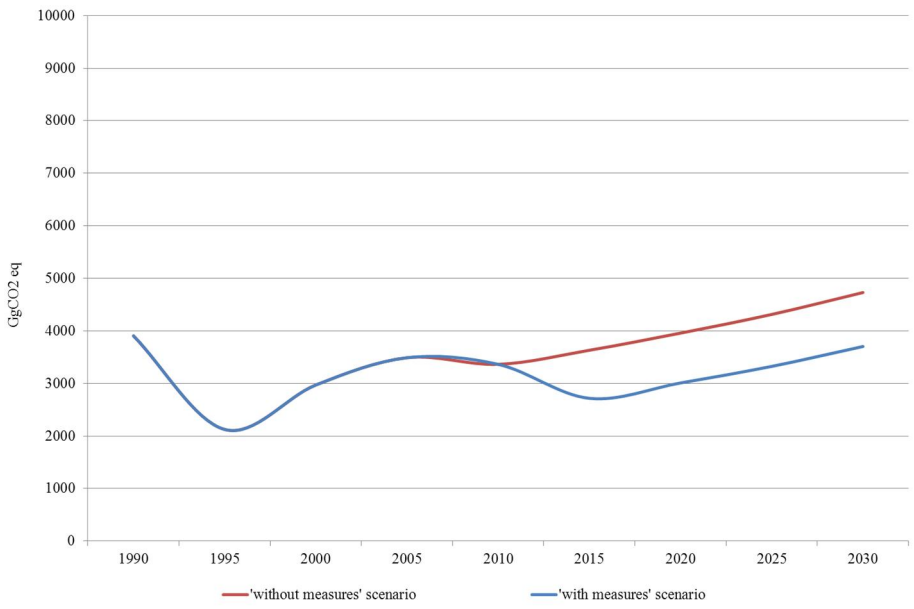

Figure 5.2-3: Historical and projected greenhouse gas emissions from industry sector

The projections of emissions indicate an increase in all scenarios, due to the expected increase in production to the maximum utilization of existing productive capacity in the period until 2030, despite the application of cost-effective measures to reduce emissions.

5.2.4. Agriculture

The agriculture sector covers about 12% of total greenhouse gas emissions.

While creating the projections in agriculture sector, two ‘without measures’ scenarios (without and with additional areas) and consequently two ‘with measures’ scenarios (without and with additional areas) were developed. The basic difference is, therefore, in the increase of agricultural land.

The ‘without measures’ and ‘with measures’ scenarios with no increase in agricultural land assume that there will be no increase in agricultural areas, the consumption of mineral fertilizers or increase of crop production. The 'with measures' scenario includes the application of measure:

- efficient manure management, which includes the proper and timely application of manure and proper storage of manure. It is assumed that this measure can reduce greenhouse gas emissions from agriculture by 15% in relation to ‘without measures’ scenario until 2020.

The ‘without measures’ and ‘with measures’ scenarios with an increase in agricultural land (all marked with +) assume that the agricultural land will be increased by about 100,000 ha till 2020 in order to ensure raw material for biofuel production. At the same time, mineral fertilizer consumption will be increased proportionally. The 'with measures' (+) scenario includes the application of measure:

- efficient manure management, for which it is assumed that it can reduce greenhouse gas emissions from agriculture by 15% in relation to ‘without measures’ (+) scenario until 2020

Historical and projected trends in greenhouse gas emissions from agriculture sector are presented in Figure 5.2-4.

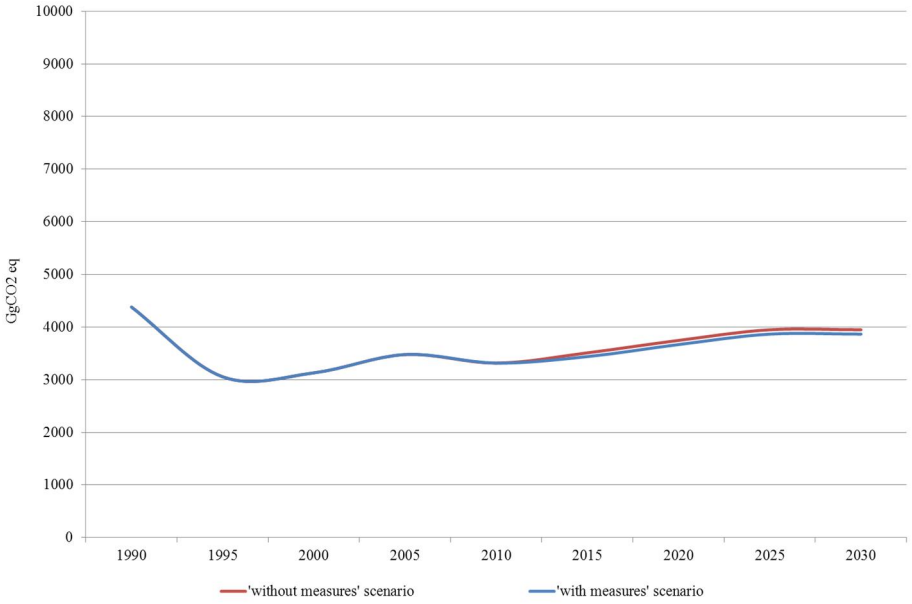

Figure 5.2-4: Historical and projected greenhouse gas emissions from agriculture sector

The projections indicate an increase in emissions by 2020 due to increasing numbers of livestock and agricultural areas. In all scenarios, emissions in 2030 remain the same as in 2025.

5.2.5. Waste management

Waste management sector contributes to the total greenhouse gas emission with about 4%, of which 72% comes from the municipal solid waste disposal at landfills, which is the key source of this sector.

In the period until 2030, greenhouse gas emission reduction in waste management could be achieved by implementation of measures, which are defined in order of priority of waste management, which is defined by the Law of sustainable waste management.

The 'without measures' scenario includes projections of greenhouse gas emission from municipal solid waste disposal at landfills, wastewater handling and waste incineration. Scenario assumes that continuous growth of the quantity of municipal solid waste will gradually slow down due to effects of basic measures for prevention of generation of waste. The plan of prevention the generation of waste, which is an integral part of the Waste Management Plan of the Republic of Croatia, has goals of preventing the generation of waste and measures necessary to achieve the

objectives of reducing or preventing the generation of waste. The quantitative targets defined by the Waste Management Strategy of the Republic of Croatia, include the following measures:

- avoiding the generation and reducing the quantity of municipal waste,
- increasing the quantity of separate collected and recycled municipal waste,
- increasing the population coverage of organized municipal waste collection system.

'With measures' and 'with additional measures' scenarios include greenhouse gas emission projections from municipal solid waste disposal at landfills. Scenarios assume the inclusion of measures defined by the Law of sustainable waste management, the Waste Management Strategy of the Republic of Croatia and Waste Management Plan of the Republic of Croatia:

- 'with measures' scenario:
  - reducing the quantities of disposed biodegradable municipal waste,
  - methane flaring,
  - use of biogas for electricity generation,
  - processing of waste for the use in cement industry.
- 'with additional measures' scenario:
  - thermal processing of municipal waste.

The CH_4 emission reduction could be achieved by decreasing the disposed biodegradable municipal waste and landfill gas flaring. Application of other measures included in 'with measures' and 'with additional measures' scenarios contributes to the CO_2 emission reduction, which is included in the energy sector.

Historical and projected trends in greenhouse gas emissions from waste management sector are presented in Figure 5.2-5.

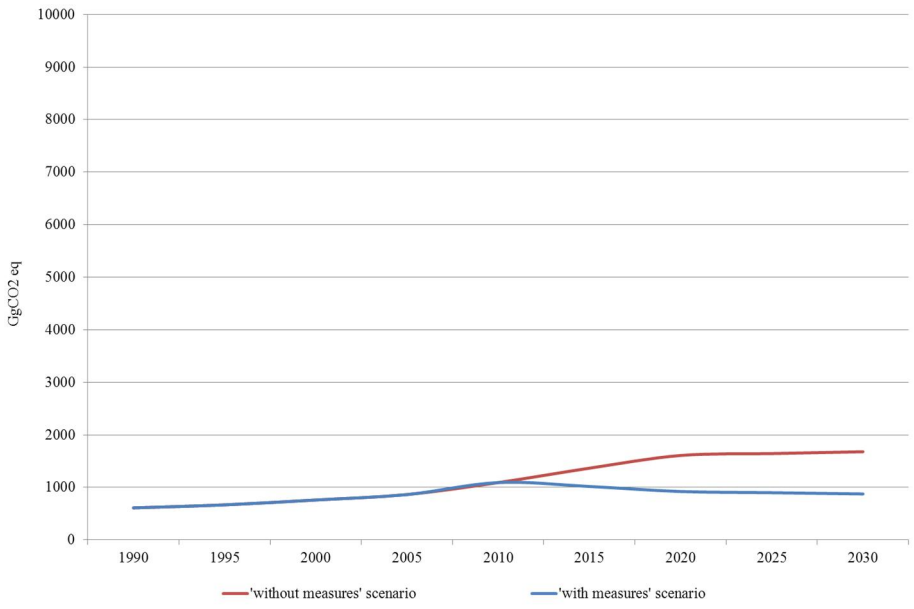

Figure 5.2-5: Historical and projected greenhouse gas emissions from waste management sector

5.2.6. Forestry

In the forestry sector, projections are made for the activities defined in Article 3.4 (Forest management) and Article 3.3 (afforestation, reforestation and deforestation) of the Kyoto Protocol.

In 'without measures' scenario, for the Forest management activity it is assumed that the change in forest area under each category of forests and forest ownership categories will follow the current trend of land areas in the period 1990-2012 year. In the case of increment, for all forests ownership categories, it is assumed that in the period up to the 2030 increase in increment will not occur as the management system will remain unchanged. In the category of state owned forests and private forests, it is assumed that the harvesting will have the same intensity as it is in 2012, while in the category of state forests managed by other legal bodies it was assumed that harvesting operations will be the average value of the last five years in this category of ownership.

In relation to the afforestation, reforestation and deforestation activities, in case of afforestation, applied assumption is that afforestation on new areas will follow the trend in period 1990-2012, and except that, there will be no additional increase in forest areas. For the deforestation, it is assumed that this activity will be carried out on areas equal to an average of areas deforested in last five years.

Projected sinks of greenhouse gases for the Kyoto Protocol do not include sinks from maquies and shrub forests since so far sinks in these forests were not estimated in Croatia.

In 'with measures' scenario are used the same assumptions as in the 'without measures' scenario for forest increment and harvest in each forests category and forest ownerships, in case of the Forest management activity. In the case of forest areas, the assumption is that some areas that are estimated and reported under the Forest Management activity are reported under the afforestation, reforestation and deforestation activity. In this case it was assumed that 10% of the area difference (area under the Forest Management and area under the Forest land remaining Forest land) should be reported as afforestation caused by human induced activity to support the natural expansion of forests on new areas. In this scenario, a contribution of sinks from maquies and shrub forests to total sinks was taken into account. It is not foreseen an additional increase in afforestation areas, other than prescribed by official forest management plans and which is in this scenario assumed to be in line with the trend in period 1990-2012. Also, by this scenario further significant increase in deforestation of forest areas is not foreseen. The applied procedure in case of determining deforestation areas is the same as the procedure described in the 'without measures' scenario.

When preparing 'with additional measures' scenario all assumptions of the 'with measures' scenario were kept. New assumption applied refers to the afforestation on new forest areas exercising greater intensity than before. Also, this scenario does not foresaw any further significant increase in deforestation of forest areas and applied procedure for determining deforestation areas is the same as in the 'without measures' scenario.

Historical and projected trends in greenhouse gas emissions from forestry sector are presented in Figure 5.2-6.

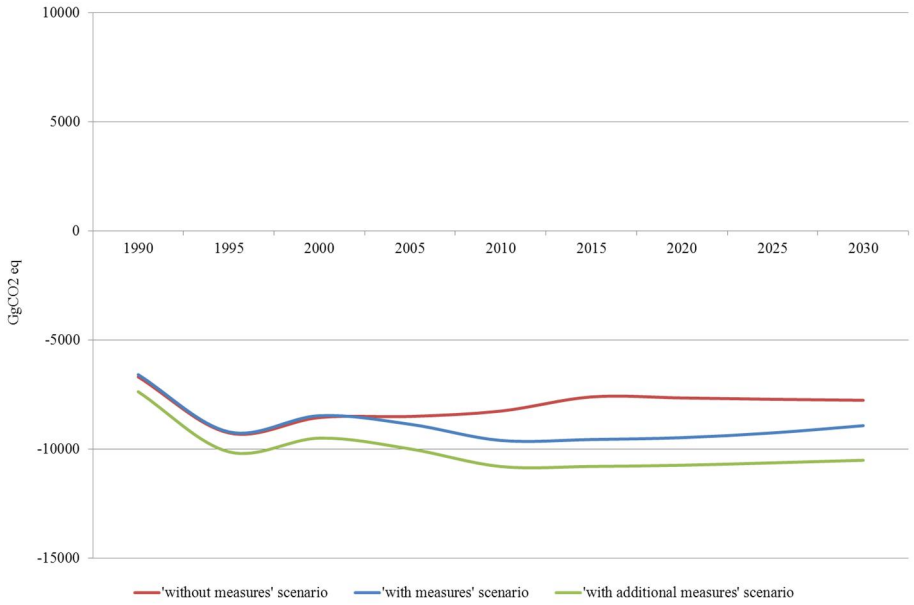

Figure 5.2-6: Historical and projected greenhouse gas emissions from forestry sector

5.3. Projections of greenhouse gas emissions by gases

Trends in emissions, by greenhouse gases (CO_2, CH_4, N_2O, HFCs and PFCs, SF_6), for all three scenarios, in the period from 1990 until 2030 are shown in Figure 5.3-1. Projections of emissions, by greenhouse gases and sectors are shown in Table 5.3-1.

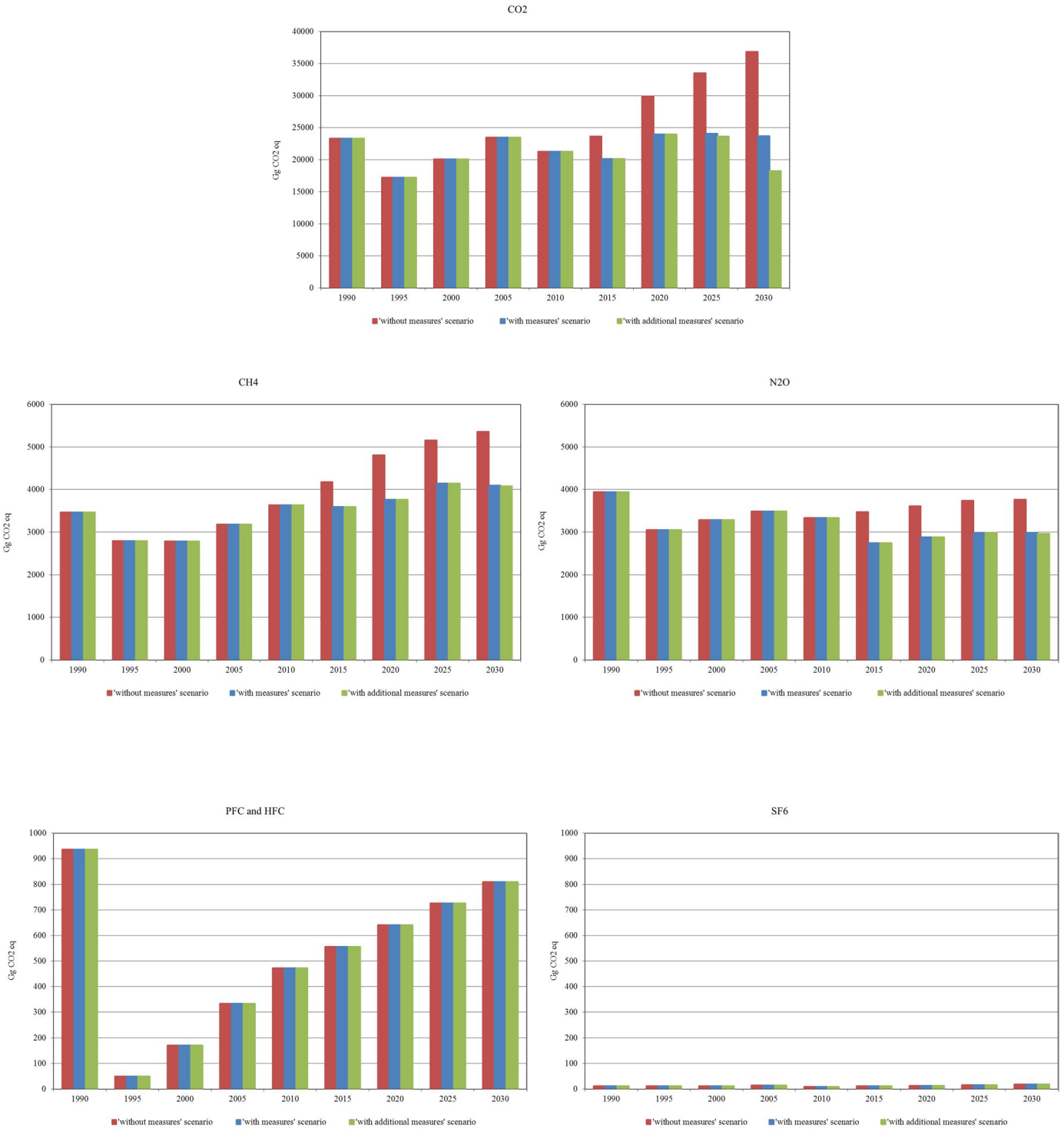

Figure 5.3-1: Projections of greenhouse gas emissions by gases

Table 5.3-1: Projections of greenhouse gas emissions by gases and sectors

	'Without measures' scenario				With measures' scenario				With additional measures' scenario			
CO2	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
Energy	14727.2	20490.8	23669.5	26675.7	11977.3	15201.2	15491.5	15119.8	11977.3	15201.2	15365.9	10321.3
Transport	6708.9	6973.1	7093.4	7101.6	6181.7	6560.2	6138.3	5844.2	6181.7	6560.2	6138.3	5250.9
Industry	2218.1	2458.2	2726.7	3056.3	1997.1	2203.1	2432.2	2723.5	1997.1	2203.1	2432.2	2723.5
Waste	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2
CH4	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
Energy	1810.0	2093.1	2311.1	2483.9	1606.3	1765.9	2084.7	2066.0	1606.3	1765.9	2084.2	2054.3
Transport	15.1	15.1	14.5	13.7	14.4	15.1	12.5	11.2	14.4	15.1	12.5	10.0
Industry	0.8	0.8	0.7	0.7	0.8	0.8	0.7	0.7	0.8	0.8	0.7	0.7
Agriculture	1098.7	1209.9	1301.6	1301.6	1066.6	1174.8	1266.6	1266.6	1066.6	1174.8	1266.6	1266.6
Waste	1255.2	1492.9	1524.6	1556.3	907.4	807.7	779.9	752.2	907.4	807.7	779.9	752.2
N2O	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
Energy	37.7	46.5	62.4	78.4	46.6	59.8	58.7	59.2	46.6	59.8	59.3	43.0
Transport	68.6	70.5	70.8	70.1	64.3	67.3	58.2	54.2	64.3	67.3	58.2	48.7
Industry	845.4	845.4	845.4	845.4	151.7	151.7	151.7	151.7	151.7	151.7	151.7	151.7
Agriculture	2411.8	2536.9	2646.8	2646.8	2372.3	2493.4	2599.2	2599.2	2372.3	2493.4	2599.2	2599.2
Waste	110.4	114.5	118.7	122.8	110.4	114.5	118.7	122.8	110.4	114.5	118.7	122.8
PFC i HFC	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
Industry	556.6	641.0	725.3	809.6	556.6	641.0	725.3	809.6	556.6	641.0	725.3	809.6
SF6	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**	**2015**	**2020**	**2025**	**2030**
Industry	10.9	12.9	15.1	17.8	10.9	12.9	15.1	17.8	10.9	12.9	15.1	17.8

The energy sector has the most significant anthropogenic sources of CO_2 emissions, with maximum value from 26,676 Gg CO_2 (for the 'without measures' scenario) to 10,321 Gg CO_2 (for the 'with additional measures' scenario) in 2030.

The main sources of CH_4 emissions are fugitive emissions from the energy sector, waste management sector and agriculture sector. Projections indicate an increase in CH_4 emissions by 2030 compared to 1990, ranging from 18% (for the 'with additional measures' scenario) to 55% (for the 'without measures' scenario).

The most important source of N_2O emissions is agriculture sector, which projections in 2030 have maximum of 2,647 Gg CO_2-eq for the 'without measures' scenario, or 2,599 Gg CO_2-eq for the 'with additional measures' scenario.

The sources of HFCs and PFCs and SF_6 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.

5.4. Total projections of greenhouse gases

Historical emissions and total projections of greenhouse gas emissions are presented in Figure 5.4-1 and in Table 5.4-1. Emissions are presented for three scenarios: the 'without measures' scenario, 'with measures' scenario and 'with additional measures' scenario, for period from 1990 to 2030.

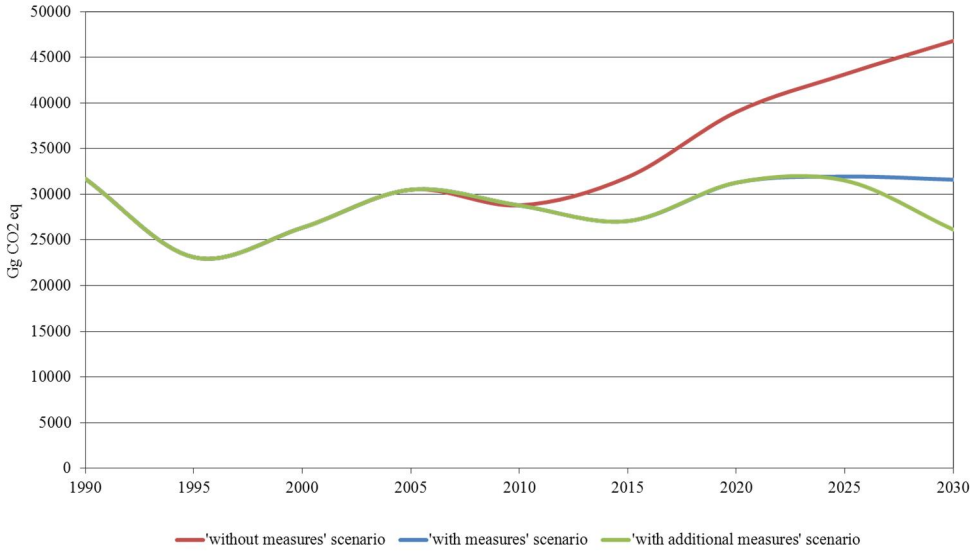

Figure 5.4-1: Historical and total projected greenhouse gas emissions

Table 5.4-1: Historical and total projected greenhouse gas emissions, Gg CO2-eq

'Without measures' scenario	1990	1995	2000	2005	2010	2015	2020	2025	2030
Energy	18701	13797	14885	16991	14970	16575	22630	26043	29238
Transport	4095	3466	4597	5681	6040	6793	7059	7179	7185
Industry	3906	2124	2970	3489	3364	3632	3958	4313	4730
Waste management	611	667	761	864	1092	1366	1608	1643	1679
Agriculture	4381	3055	3130	3478	3316	3511	3747	3948	3948
TOTAL	**31693**	**23110**	**26344**	**30503**	**28781**	**31876**	**39002**	**43127**	**46781**

With measures' scenario	1990	1995	2000	2005	2010	2015	2020	2025	2030
Energy	18701	13797	14885	16991	14970	13630	17027	17635	17245
Transport	4095	3466	4597	5681	6040	6260	6643	6209	5910
Industry	3906	2124	2970	3489	3364	2717	3009	3325	3703
Waste management	611	667	761	864	1092	1018	922	899	875
Agriculture	4381	3055	3130	3478	3316	3439	3668	3866	3866
TOTAL	**31693**	**23110**	**26344**	**30503**	**28781**	**27065**	**31269**	**31934**	**31599**

With additional measures' scenario	1990	1995	2000	2005	2010	2015	2020	2025	2030
Energy	18701	13797	14885	16991	14970	13630	17027	17510	12419
Transport	4095	3466	4597	5681	6040	6260	6643	6209	5310
Industry	3906	2124	2970	3489	3364	2717	3009	3325	3703
Waste management	611	667	761	864	1092	1018	922	899	875
Agriculture	4381	3055	3130	3478	3316	3439	3668	3866	3866
TOTAL	**31693**	**23110**	**26344**	**30503**	**28781**	**27065**	**31270**	**31808**	**26173**

Projections show that compared to the year 1990, in 2030 the emission suddenly increases by 48% in the 'without measures' scenario. In the scenario 'with measures', the emission in 2030 remains approximately the same as in 1990, while in the scenario 'with additional measures' emission is reduced by 17% compared to 1990.

In the 'with additional measures' scenario, after 2025, it expected suddenly decrease in emission due to the assumption of use of the technology for capture and geological storage of CO_2 (CCS) in new coal and gas fired power plants and the use of CO_2 injection technology for enhanced oil recovery (EOR).

The 'with measures' scenario reduces the emissions of greenhouse gases in 2030 by 32.5% in relation to the 'without measures' scenario, while 'with additional measures' scenario reduces emissions by 44%.

5.5. Total effect of policies and measures

The total effect of policies and measures are shown in Table 5.5-1.

Table 5.5-1: Total effect of policies and measures

	2015	2020	2025	2030
'Without measures' scenario, Gg CO_2-eq	31,876	39,002	43,127	46,,781
'With measures' scenario, Gg CO_2-eq	27,65	31,269	31,934	31,599
TOTAL	**4,811**	**7,732**	**11,194**	**15,182**

Comparing the 'without measures' scenario with scenario which provides the application of policies and measures which application is already in progress and the application of adopted policies and measures ('with measures' scenario), the total effects of the applied policies and measures are determined. Reducing emissions is from 4,811 Gg CO2-eq in the year 2015 to 15,182 Gg CO2-eq in year 2030 (Figure 5.5-1).

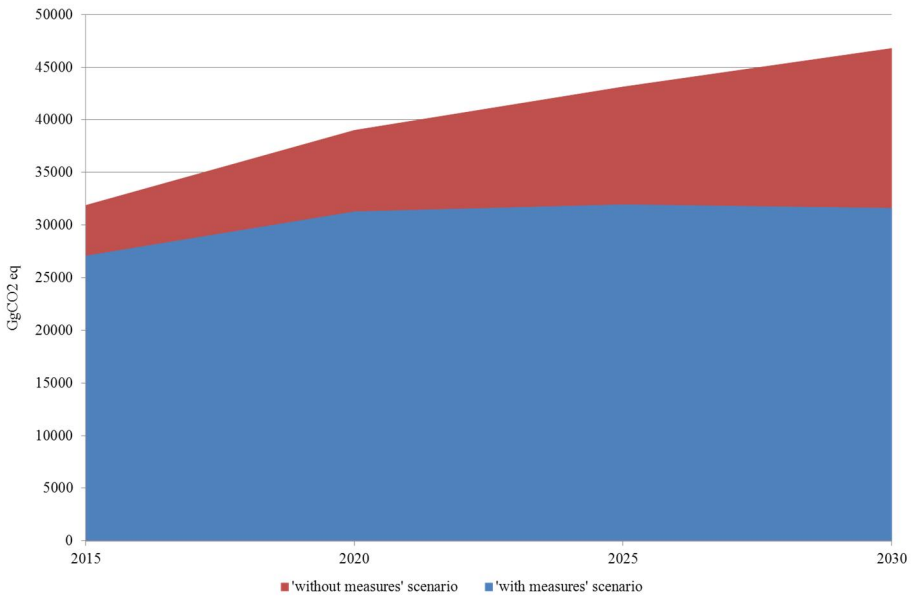

Figure 5.5-1: Total effect of policies and measures

5.6. The effect of the application of the Clean Development Mechanism, Joint Implementation and Emission Trading as a supplementary measure to reduce greenhouse gas emissions

About the current effect of the application of the Kyoto Protocol mechanisms is still unable to speak since Croatia this mechanism has not been used yet. Domestic measures were the only measures applied to reduce emissions and increase sinks of greenhouse gases. The Regulation on the implementation of the flexible mechanisms (OG 142/08), which is prescribed manner of

implementation of the flexible mechanisms, is still in force. From 1 January 2013, the Republic of Croatia is fully integrated in the EU emission trading system (EU ETS), which means that the emission trading at the level of electricity producers and industrial plants is in application. Plans for the implementation of project mechanisms, i.e. for investment in clean development mechanism and joint implementation which Croatia would gain units CERs and ERUs, have not made yet.

5.7. Descriptions of methodologies, models, underlying assumptions and key input parameters for projections

For preparing the projections, the ISPE (Inventory System Projection and Estimation) model has been used, performed in tabular calculation interface. The model is structured in accordance with tabular structure of the emission inventory United Nations Framework Convention on Climate Change.

Optimization of electric power system, as regarding the optimum structure of new sources, is being performed separately (analysis within the preparation of the Strategy of Energy Sector), while entering into the ISPE model as complete scenario, the same as other data on activities and technologies.

The model is detailed, to the level of individual production units, present and future.

Projections are being made until 2020, indicatively until 2030, with a step of five years. It is the 'bottom-up' model type, as starts with sectoral data and CO_2, CH_4 and N_2O emissions are being calculated.

Assumptions used in preparation of projections are shown Table 5.7-1.

Table 5.7-1: Assumptions for projections by sector

ENERGY	
	Projections were conducted on the basis of correlation of key parameters with the planned GDP growth, population trends, expected development of some of the sectors and sub-sectors, analogy and catching up the developed countries. Method consisting of two phases was used: – Bottom-up sectoral analysis for the preparation of the Strategy of Energy Sector: the method of analogy (in terms of approaching the EU), and the method of trend (previous trend extrapolation using exponential function). Conducted every 5-8 years. – Top-down corrections of total consumption and descending to the sectors. Conducted every 2-3 years. Projections are made for: – basic (baseline scenario), in this case the basis for the scenario 'without measures' – sustainable scenario, in this case the basis for the 'with measures' and 'with additional measures' scenarios.
INDUSTRY	
	Projections were conducted based on expected development of certain industrial branches. The used method is the method of trend (extrapolation of previous trends using exponential functions) that includes production goals by 2030 (the results of sectoral studies – cement production, lime production, nitric acid production and ammonia production). Assumptions:

	– no installation of additional capacity, – production will reach the maximum values by 2030.
AGRICULTURE	
	Projections were conducted based on expected future state of the key parameters. For the determination of key parameters for the projections (the number and types of livestock, crop production) was used expert estimates that include historical data and sectoral strategic and development documents. Assumptions: – Uncertainty of estimates due to a lack of adequate and reliable statistics and economic indicators.
WASTE MANAGEMENT	
	Projections were conducted based on expected development and future state of the parameters for making projections (the quantity of waste produced, the organic fraction of municipal solid waste, the quantity of municipal solid waste disposed to landfills). The used method is the method of trend (extrapolation of previous trends using exponential functions) that includes goals by 2030. The goals are defined by sectoral strategic documents - the Waste management strategy and the Waste management plan of the Republic of Croatia and the Law of sustainable waste management. Assumptions: – continuous growth of the quantity of municipal solid waste will be gradually slowed down due to effects of basic measures defined by strategic documents.
FORESTRY	
	Projections were conducted based on expected future state of the parameters that determine the potential for mitigating emissions. Key parameters for projections (increment, forest area, allowable cut, wood volume) have been determined by the Forest Management Plan 2006-2015 and based on expert assessment. Assumptions: – The definition of forests for the purpose of reporting under the Kyoto Protocol (Article 3, paragraphs 3 and 4): – minimum crown cover: 10% – minimum size of the area: 0.1 ha – minimum tree height: 2 m

'With measures' and 'with additional measures' scenarios includes policies and measures to reduce emissions from sources and increase sinks of greenhouse gases. For determining the contribution of each policy and measure in reducing the emissions, reduction potential is determined. In cases where the emission reduction potential of individual policies and measures cannot be expressed separately, it is expressed as aggregated with potential of other policies and measures. Key parameters used in preparation of projections are shown Table 5.7-2.

Table 5.7-2: Key parameters for projections

Parameter		**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
GDP – annual growth rate	%	4.2	-1.2	3.5	4	3	2.5
Population	million people	4.440	4.425	4.405	4.366	4.320	4.267
Coal prices	Euro/GJ	5.09	5.09	5.09	5.09	5.09	5.09
Oil prices	Euro/GJ	10.12	10.12	10.12	10.12	10.12	10.12
Gas prices	Euro/GJ	9.69	9.69	9.69	9.69	9.69	9.69
Heating degree days:		2,479					
Number of days of heating:		167					

Differences in assumptions with respect to the Fifth National Report

Assumptions related for economic development are fundamental factor of projections. The projections described in Fifth National Report are based on the assumption of stable economic growth of Gross Domestic Product (GDP) of 5% per annum to 2020. With steady economic growth of 5% per annum starting from the year 2005, GDP would rise for a total of 108% by year 2020. Such an increase, GDP per capita in 2020 would be approximately at the level of the present EU 27 average.

The economic and financial crisis results in a GDP decrease. Instead of the planned GDP growth of 21.5% in the period from 2009 to 2012, a negative rate of -9.0% was achieved, which represents the difference of 30.5%.

6. VULNERABILITY ASSESSEMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

6.1. Global climate change

The Earth's climate fluctuates over seasons, decades and centures in responnse to both natural and human variables. Natural climate variability on different timescales is caused by cycles and trends in the Earth's orbit (Milanković, 2002), incoming solar radiation, the atmosphere's chemical composition, ocean circulation, the biosphere, cryosphere and much more (WMO, 2013).

6.1.1. The warmest decade

A study of World Meteorological Organization (WMO, 2013) indicates that a pronounced increase in the global air temperature occurred over the four decades i.e. during period 1971-2010 (Figure 6.1.1-1 and 6.1.1-2). The global temperature increased at an average estimated rate of 0.17°C per decade during that period while during the whole period 1880-2010 was only 0.062 °C per decade. Furthermore, the increase of 0.21°C in average decadal temperature from 1991-2000 to 2001-2010 is larger than the increase from 1981-1990 to 1991-2000 (0.14°C) and larger than between any other two successive decades since the beginning of instrumental records. Nine of the decade's years were among the 10 warmest on record. The warmest year ever recorded was 2010.

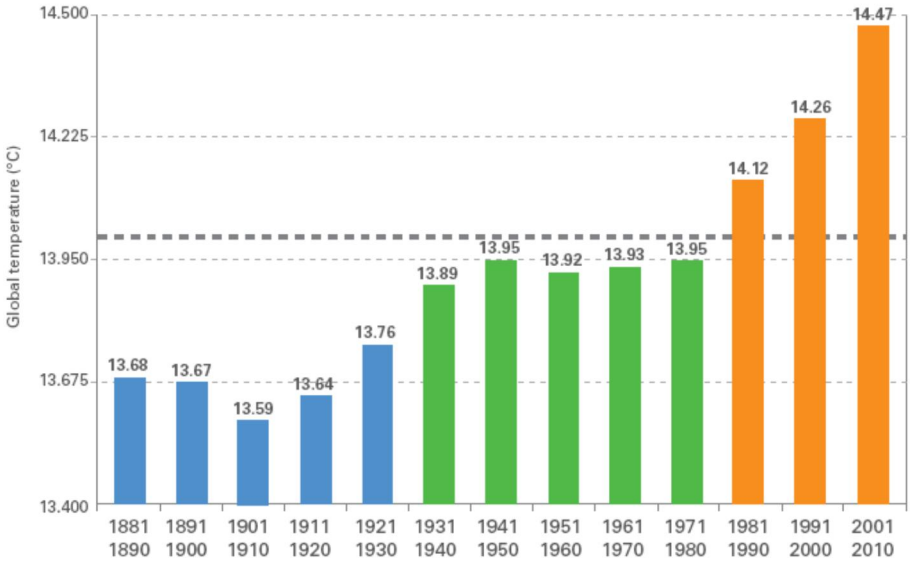

Figure 6.1.1-1 Decadal global combined surface air temperature over land and sea-surface temperature (°C). The horizontal grey line indicates the long-term average value for the period 1961-1990 (14°C). (WMO, 2013)

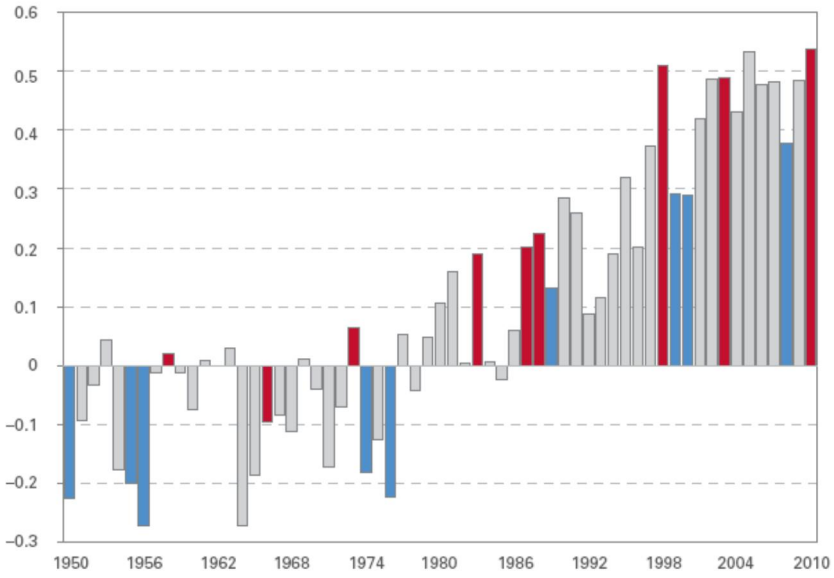

Figure 6.1.1-2 Annual global surface temperature anomalies (°C) for the period 1950-2010 with reference to the 1961-1990 base period, indicating the years with La Nina events (blue) and those with El Nino events (red). (WMO, 2013)

6.1.2. „Hot“ and „cold“ extremes

While the average annual air temperature is an important climate indicator, the temperatures that people experience can differ greatly from day to day and over the course of a year because of natural climate variability. At the same time, human influence has probably increased the maximum temperatures of the most extreme hot nights and days and the minimum temperatures of cold nights and cold days. It is also more likely than not that human-induced climate change has increased the risk of heatwaves (WMO, 2013).

According to the WMO survey, a total of 56 countries (44 per cent) reported their highest absolute daily maximum temperature record over the period 1961–2010 being observed in 2001–2010 compared to 24 per cent in 1991–2000, with the remaining 32 per cent spread over the earlier three decades. Conversely, 11 per cent (14 out of 127) of the countries reported their absolute daily minimum temperature record being observed in 2001–2010, compared to 32 per cent in 1961–1970 and around 20 per cent in each of the intermediate decades (Figure 6.1.2-1).

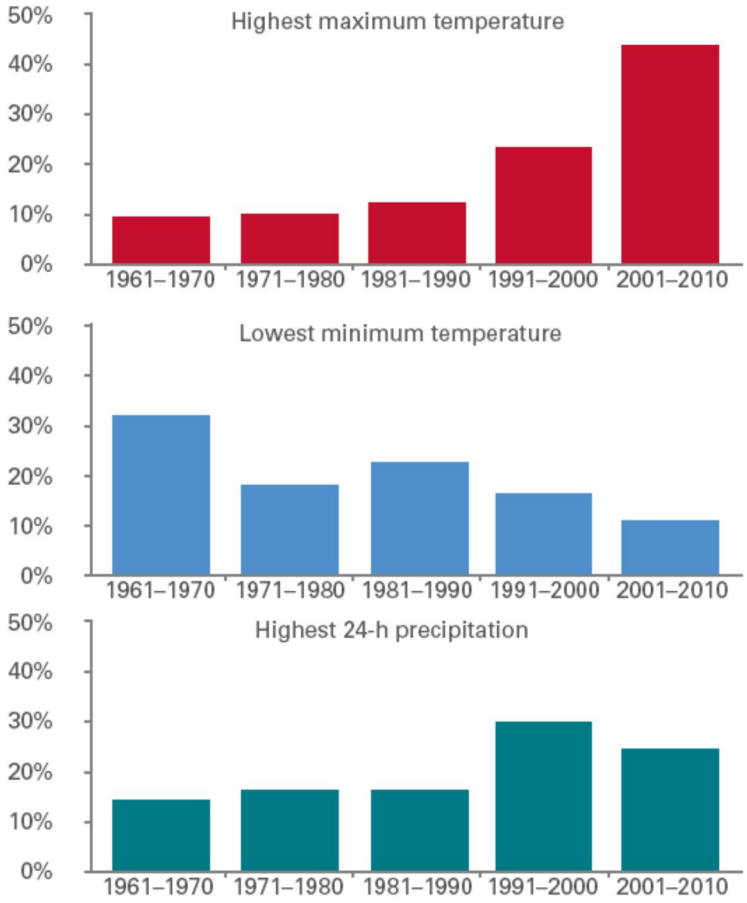

Figure 6.1.2-1 Absolute country records of the daily maximum and minimum air temperature and 24-hour precipitation in the last five decades (WMO, 2013)

6.1.3. Ice cover on Artic

Arctic sea-ice extent was well below multiannual average for the period 1979-2000 in 5 years during period 2001-2011 (Figure 6.1.3-1). After tracking at record or near-record low levels for the time of year through the first half of 2011, the seasonal minimum extent, reached on 9 September, was 4.33 million km^2, 35 per cent below the 1979–2000 average, according to the United States National Snow and Ice Data Center. This was the second-lowest seasonal minimum on record, 0.16 million km^2 above the record low set in 2007. Unlike the 2007 season, both the North-West and North-East Passages were ice-free for periods during the 2011 summer. Sea-ice volume was even further below average and was estimated at a new record low of 4 200 km^3, surpassing the record of 4 580 km^3 set in 2010 (WMO, 2012).

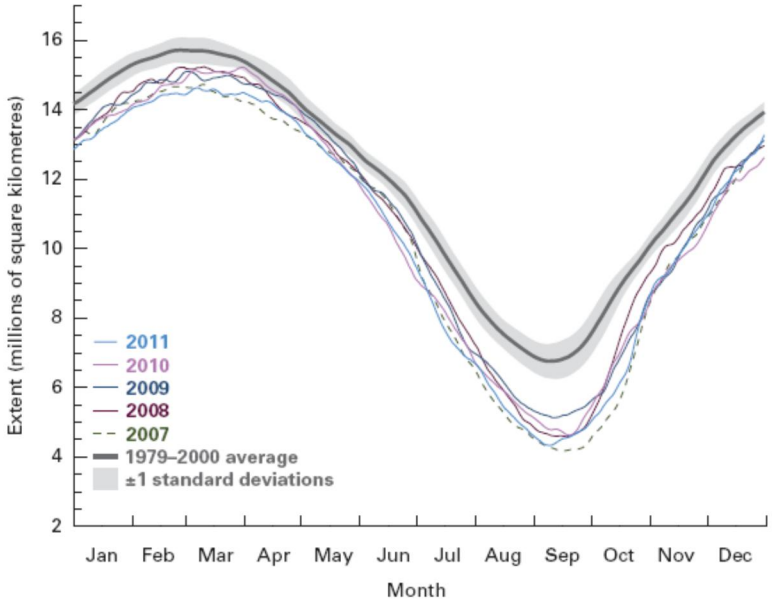

Figure 6.1.3-1 Northern hemisphere sea-ice extent in 2011, compared with previous years and the 1979–2000 average (WMO, 2012).

6.2. Observed climate change in Croatia

Climate change in Croatia over the period 1961-2010 has been determined by trends in annual and seasonal mean air temperature, mean minimum and mean maximum temperature; and in indices of temperature extremes; then in precipitation amounts and precipitation indices, as well as in dry and wet spells. The analyses are based on data from 41 mean, minimum and maximum daily temperature series and 137 daily precipitation series. The indices of temperature and precipitation extremes are calculated according to the definitions given by ETCCDI (Expert Team on Climate Change Detection and Indices) (Peterson et al. 2001; WMO 2004), Commission for Climatology (WMO/CCL) and World Climate Research Programme, Climate Variability and Predictability (WCRP/CLIVAR). The non-parametric Mann-Kendall rank test (Gilbert, 1987) was applied to assess statistical significance of trends at the 95% confidence level. The field significance test is based on the Monte Carlo simulation (Zhang et al. 2004).

6.2.1. Air temperature

Temperature trends were calculated for the temperature deviations from the associated 1961-1990 means, and expressed in °C per decade, while trends in indices of temperature extremes are expressed by number of days per decade.

Trends in air temperature (mean, mean minimum and mean maximum temperature) show warming all over Croatia (Figure 6.2.1-1). Annual temperature trends are positive and significant, and the changes are higher on the mainland than at the coast and the Dalmatian hinterland. The maximum temperature values were exposed to the greatest changes (Figure 6.2.1-1) with the highest frequency of trends in the class of 0.3-0.4 °C per decade, while trends in the mean and the mean minimum air temperatures mostly range between 0.2 and 0.3°C per decade. The overall positive trend in the annual air temperatures comes are mainly caused by the significant positive summer trends, while the trends for the winter and spring gave almost equal contribution to the

increasing trends of mean maximum temperature. Autumn temperatures are subjected to small changes and they are mostly positive, though mainly insignificant.

Observed warming can be seen in all indices of temperature extremes, with positive trends of warm temperature indices (warm days and nights as well as warm spell duration index) and with the negative trends of cold temperature indices (cold days and nights and cold spell duration index) (Fig. 6.2.1-2).

All trends of indices of warm temperature extremes are statistically significant which is confirmed with the field significance trend (Figure 6.2.1-2 left). The most prominent increases are found in the number of warm days (Tx90) and warm nights (Tn90), and slightly lower trends are found in summer days (SU, absolute thresholds) and warm spell duration (WSDI). At most stations, the increase of the number of SU ranges between 2 and 8 days per decade (Table 6.2.1-2). Increase in the number of warm days (Tx90) most often accounted 6-10 days and warm nights (Tn90) even 8-12 days per decade. The duration of warm spells at most stations has increased for 4-6 days.

Warming is also evident in the observed negative trend in the indices of cold temperature extremes, but they are less expressed than the trends of warm indices (Figure 6.2.1-2 right). Cold days and cold nights (Tx10 and Tn10) have the most significant trends, and their number at most stations is reduced for up to 4 days per decade, while the trends in the number of cold days (FD, absolute thresholds) are smaller and are mostly reduced for up to 2 days per decade (Table 6.2.1-2). The smallest changes are observed in the cold spell duration index (CSDI) which show a decrease by 2 days per decade at the majority of stations (more than 90% of stations). Nevertheless, the trend is not statistically significant.

Table 6.2.1-1. List of the indices of temperaturne extremes and their definition. The abbreviations and definitions are according to standardisation of WMO-CCL/CLIVAR working group for climate change

Indices of cold temperature extremes		
FD	Frost days (absolute threshold	Number of days with minimum temperature below 0°C
TN10%	Cold nights (percentile threshold)	Number of days with minimum temperature (TN) below the 10th percentile from the 1961-1990 baseline period.
TX10%	Cold days (percentile threshold)	Number of days with maximum temperature (TX) below the 10th percentile from the 1961-1990 baseline period
CSDI	Cold spell duration index	Number of days in periods with at least 6 consecutive days with minimum temperature below TN10%
Indices of warm temperature extremes		
TN90%	Warm nights (percentile threshold)	Number of days with minimum temperature (TN) above the 90th percentile from the 1961-1990 baseline period
TX90%	Warm days (percentile threshold)	Number of days with maximum temperature (TX) above the 90th percentile from the 1961-1990 baseline period
WSDI	Warm spell duration index	Number of days in periods with at least 6 consecutive days with minimum temperature above TX90%
SU	Summer days (absolute threshod)	Number of days with maximum temperature ³25°C

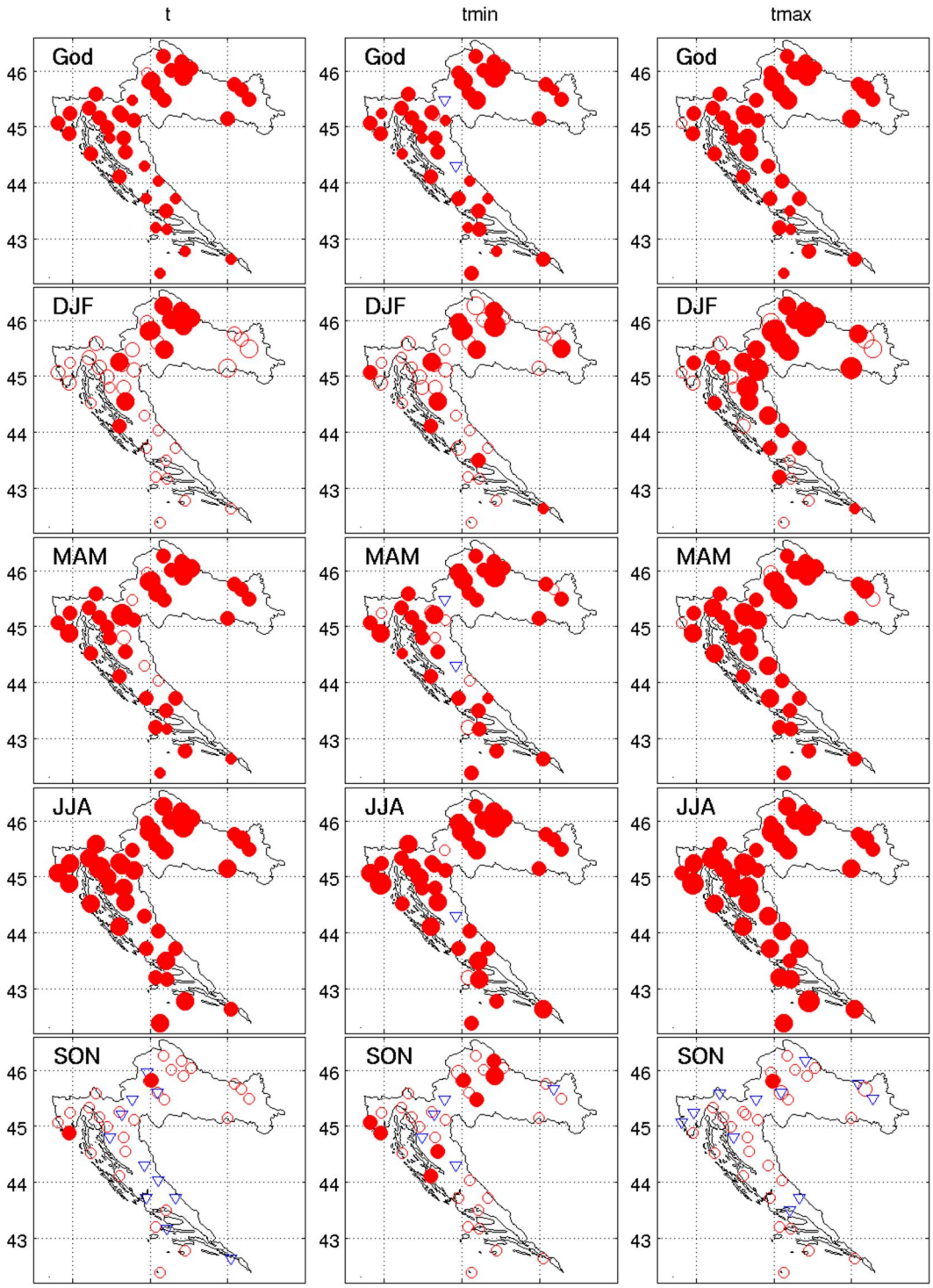

Figure 6.2.1-1. Decadal trends (°C/10yrs) in annual and seasonal (DJF-winter, MAM-spring, JJA-summer, SON-autumn) mean (t), mean minimum (tmin) and mean maximum temperature (tmax) values in the 1961-2010 period. Circles denote positive trends, triangles the negative one, whereas filling means statistically significant trend. Four sizes of symbols are proportional to the absolute value of change (in °C) per decade relative to the respective average from the period 1961-1990: <0.2, 0.2-0.4, 0.4-0.6 and >0.6, respectively

Table 6.2.1-2. Relative frequency of trend values (number of days in 10 years) in warm (SU, Tx90, Tx10, WSDI) and cold (FD, Tx10, Tn10, CSDI) temperature indices at 41 meteorological stations in Croatia

Trend	SU	Tx90	Tn90	WSDI	FD	Tx10	Tn10	CSDI
≤-6,0	0,0	0,0	0,0	0,0	2,4	0,0	2,4	0,0
-5,9-4,0	0,0	0,0	0,0	0,0	7,3	7,3	17,1	0,0
-3,9-2,0	0,0	0,0	0,0	0,0	36,6	**63,4**	**39,0**	2,4
-1,9-0,0	0,0	0,0	0,0	0,0	**43,9**	29,3	31,7	**92,7**
0,1-2,0	4,9	0,0	2,4	0,0	7,3	0,0	7,3	4,9
2,1-4,0	29,3	0,0	2,4	29,3	2,4	0,0	2,4	0,0
4,1-6,0	**36,6**	2,4	12,2	**46,3**	0,0	0,0	0,0	0,0
6,1-8,0	29,3	**29,3**	12,2	14,6	0,0	0,0	0,0	0,0
8,1-10,0	0,0	26,8	22,0	9,8	0,0	0,0	0,0	0,0
10,1-12,0	0,0	17,1	**24,4**	0,0	0,0	0,0	0,0	0,0
12,1-14,0	0,0	19,5	14,6	0,0	0,0	0,0	0,0	0,0
14,1-16,0	0,0	4,9	4,9	0,0	0,0	0,0	0,0	0,0
16,1-18,0	0,0	0,0	2,4	0,0	0,0	0,0	0,0	0,0
18,1-20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
>20,0	0,0	0,0	2,4	0,0	0,0	0,0	0,0	0,0

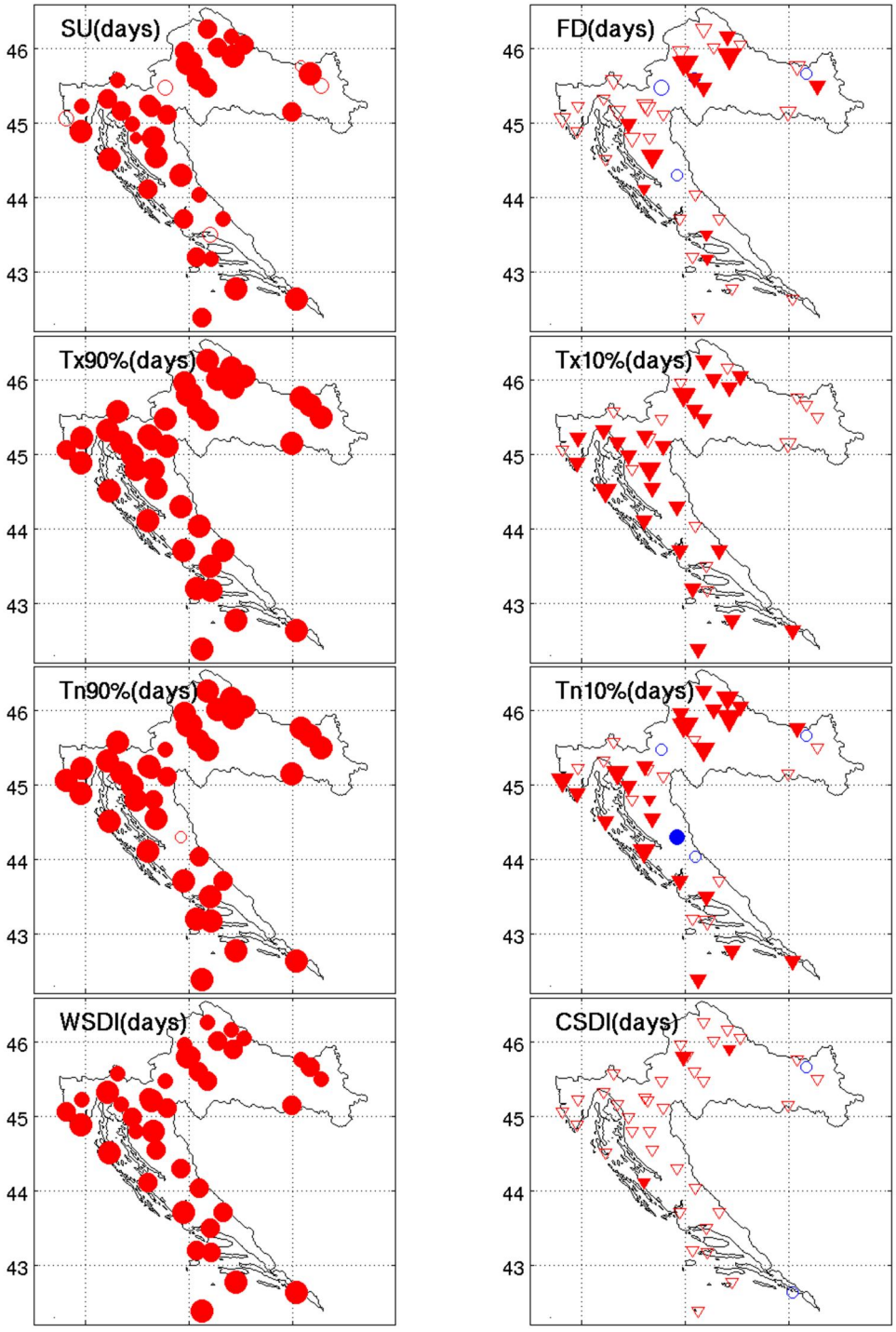

Figure 6.2.1-2 Decadal trends (days/10yrs) in annual extreme temperature indices in the 1961-2010 period. Circles denote positive trends, triangles the negative one, whereas filling means statistically significant trend. Four sizes of symbols are proportional to the absolute value of change (in days) per decade relative to the respective average from the period 1961-1990: <2, 2-4, 4-6 and >6, respectively

6.2.2. Precipitation

Trends in annual and seasonal precipitation amounts give a general overview of the temporal change in precipitation over the country. During the recent 50-year period (1961-2010) the annual precipitation amounts (*R*) experienced prevailing insignificant trends that are increasing in the eastern lowland and decreasing elsewhere (Fig. 6.2.2-1. (a)). The statistically significant decreases (filled symbols) are found for the stations in the mountainous region of Gorski kotar and in the Istria peninsula (northern Adriatic) as well as in the southern coastal region. Expressed per decade as percentages of the respective average values, these decreases range between -7% and -2%. Annual negative trends are mainly caused by decreasing trends in summer amounts (*R-JJA*), which are found to be statistically significant at most stations in the mountainous region and at some stations along the Adriatic and its hinterland (Fig. 6.2.2-1. (b)). The statistical significance of the annual negative trend in Istria and Gorski kotar is also influenced by spring negative tendencies (from -8% to -5%; Fig. 6.2.2-1. (c)). Positive (circles) annual trends in eastern lowland are primarily caused by the significant increasing trends in autumn (Fig. 6.2.2-1.(d)) and to a less extent in spring and summer. The geographical distribution of trends for seasons also shows interesting features. Summer precipitation shows a clear prominence of negative trend estimates all over the country and there is a number of stations for which this decrease is statistically significant, with the relative change between -11% and -6% per decade. In autumn, the trends are weak and mixed in sign, except in the eastern lowland where some locations show significant increasing trend in precipitation (8% to 11%). In spring results suggest no signal in the southern and eastern part of the country, while a negative tendency seems to affect the rest of the country, significantly only in Istria and Gorski kotar (-5% to -7%). During winter season (Fig. 6.2.2-1. (e)), precipitation trends are not significant and they range between -11% and 8%. They are mostly negative at the southern and eastern parts as well as at Istria peninsula. The trends of mixed signs are found in the rest of the country.

Regional distribution of trends in precipitation indices, that define magnitude and frequency of precipitation extremes, shows complex structure, as it is also found for some Mediterranean regions.

Spatial distribution of trends in frequency of dry and wet precipitation extremes as indicated by number of dry days (*DD*), moderate wet days (*R75*) and very wet days (*R95*) are presented in Fig. 6.2.2-1. (f, g, h). The trends in *DD* are predominantly weak, but statistically significant positive trends (1% to 2%) appear at some stations in the mountainous region of Gorski kotar, Istria peninsula and in the southern coastal region. The trend pattern of *R75* is spatially very similar to the annual precipitation one. The regional distribution of *R95* trends shows no signal over the majority of the country. Statistically significant changes are present at few stations; positive over the northern lowlands and negative in the highlands of Gorski kotar as well as at the very southern coast.

Trends in the intensity of precipitation for wet days (Fig. 6.2.2-1. (i)), as measured by the simple daily intensity index (*SDII*), reflect changes of trend magnitudes in two variables, annual amounts and annual number of wet days. For example, for two stations in different regions (indicated by two arrows in Fig. 6.2.2-1. (i)), the same change in frequency of R_d (in these cases significant decrease, see Fig. 6.2.2-1. (f)) but different changes in *R*, resulted in the similar significant increase in *SDII* at both stations. It implies that *SDII* is not suitable for explaining the causes of changes in *R*. Because of this fact, this index and its trends should be used with caution in application studies.

Table 6.2.2-1. List of the precipitation indices and their definitions

Nr.	Indices	Unit	Definition
1	DD	days	Dry days (absolute extreme) *(Number of days with daily precipitation amount R_d<1.0 mm)*
2	SDII	mm/day	Simple daily intensity index (absolute extreme) *(annual precipitation amount / annual number of wet days (R_d≥1.0 mm)*
3	R75	days	Moderate wet days (percentile threshold) *(Number of days with precipitation R_d>$R_{75\%}$, where $R_{75\%}$ is the 75th percentile of the distribution of daily precipitation amounts at days with 1 mm or more precipitation in the 1961-1990 baseline period*
4	R95	days	Very wet days (percentile threshold) *(Number of days with precipitation R_d>$R_{95\%}$, where $R_{95\%}$ is the 95th percentile of the distribution of daily precipitation amounts at days with 1 mm or more precipitation in the 1961-1990 baseline period*
5	R25T	%	Precipitation fraction due to days with R_d<$R_{25\%}$ (percentile threshold) *(Fraction of annual total precipitation $\sum R_d/R_t$, where $\sum R_d$ indicates the sum of daily precipitation less than the 25th percentile of precipitation at days with $R_{25\%}$ in the 1961-1990 baseline period. a R_t is the total annual precipitation amount.*
6	R25-75T	%	Precipitation fraction due to days with $R_{25\%}$≤R_d≤$R_{75\%}$ (percentile threshold) *(Fraction of annual total precipitation $\sum R_d/R_t$, where $\sum R_d$ indicates the sum of daily precipitation equal to or exceeding the 25th percentile of precipitation at days with $R_{25\%}$ and equal to or less than the 75th percentile of precipitation at days with $R_{75\%}$ in the 1961-1990 baseline period. R_t is the total annual precipitation amount.*
7	R75-95T	%	Precipitation fraction due to days with $R_{75\%}$<R_d≤$R_{95\%}$ (percentile threshold) *(Fraction of annual total precipitation $\sum R_d/R_t$, where $\sum R_d$ indicates the sum of daily precipitation exceeding the 75th percentile of precipitation at days with $R_{75\%}$ and equal to or less than the 95th percentile of precipitation at days with $R_{95\%}$ in the 1961-1990 baseline period. R_t is the total annual precipitation amount.*
8	R95T	%	Precipitation fraction due to very wet days (percentile threshold) *(Fraction of annual total precipitation $\sum R_d/R_t$, where $\sum R_d$ indicates the sum of daily precipitation exceeding the 95th percentile of precipitation at very wet days $R_{95\%}$ in the 1961-1990 baseline period*
9	Rx1d	mm	Highest 1-day precipitation amount (absolute extreme) *(Maximum precipitation sums for 1-day intervals)*
10	Rx5d	mm	Highest 5-day precipitation amount (absolute extreme) *(Maximum precipitation sums for 5-day intervals)*

Fraction of annual total precipitation due to different classes of daily precipitation was analysed over the full-scale of daily precipitation categories. Four classes with percentile thresholds define the following indices: *R95T*, *R75-95T*, *R25-75T* and *R25T* (Table 6.2.2-1.). The trend patterns of these indices are presented in Fig. 6.2.2-1. (j-m). Two opposite categories, that of very high precipitation extremes (R95T) and that of light precipitation extremes (R25T), show prevailing weak trends that are quite mixed in sign over the country. Only some locations seem to be affected by significant trends. Significant positive trend in R25T is found in the western Croatia

(including NW region, Gorski kotar and Istria) and along the southern Adriatic coast. In the eastern lowland of Croatia a positive trend in annual precipitation amount is associated with a significant positive trend in R95T. Contribution to annual amounts of daily precipitation from the central part of the distribution (*R25-75T*) shows weak changes of mixed sign (-7% to 7%). The similar is true for trends in the fraction of annual precipitation due to moderate wet days (*R75-95T*). Though, there is a significant positive trend found at few stations in the mountainous regions, as well as at the northern and middle Adriatic, despite the reduction in frequency of such days. Over the southern coastal region the *R75-95T* shows negative trends that can be related to the negative tendency in *R75*.

The first information about temporal changes in annual extremes as defined by maximum 1-day precipitation (*Rx1d*) and multi-daily precipitation episode as defined by maximum 5-day precipitation (*Rx5d*) is presented by relative changes in their linear trends in Fig. 6.2.2-1. (f-g). Trend direction of both indices is generally in agreement along the respective regions. Trend is weak in magnitude and predominantly positive in the eastern lowland and along the coast; while it is mostly negative in NW area and in the mountainous regions (significant for *Rx1d*).

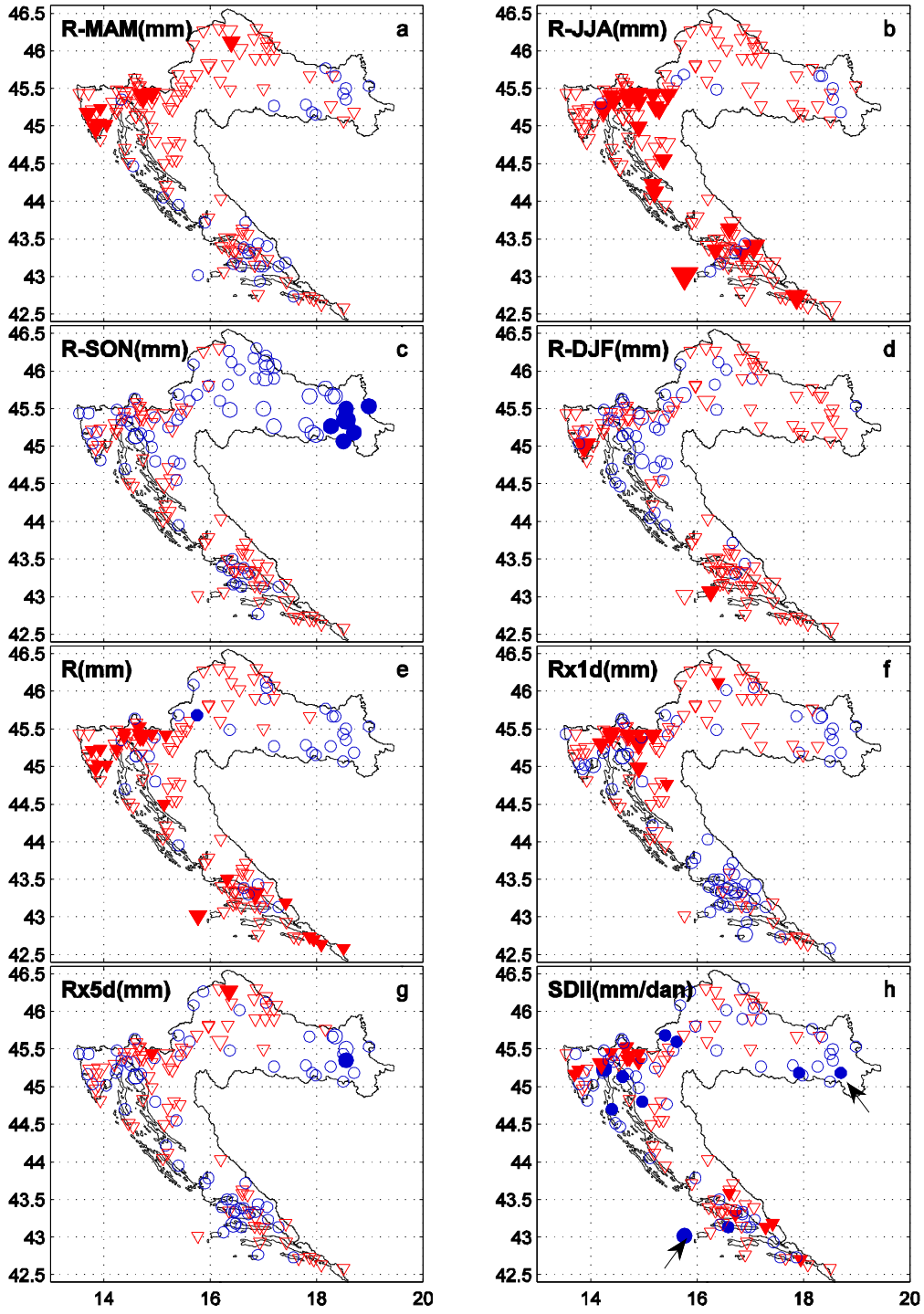

Figure 6.2.2-1. Decadal trends (%/10yrs) in seasonal and annual precipitation (R-MAM, R-JJA, R-SON. R-DJF, R) and precipitation indices (Rx1d, Rx5d, SDII, R75, R95, R25T, R25-50T, R50-75T, R75-95T, R95T and DD) in the 1961-2010 period. Circles denote positive trends, triangles the negative one, whereas filling means statistically significant trend. Four sizes of symbols are proportional to the absolute value of change per decade relative to the respective average from the period 1961-1990: <5%, 5-10%, 10-15% and >15%, respectively

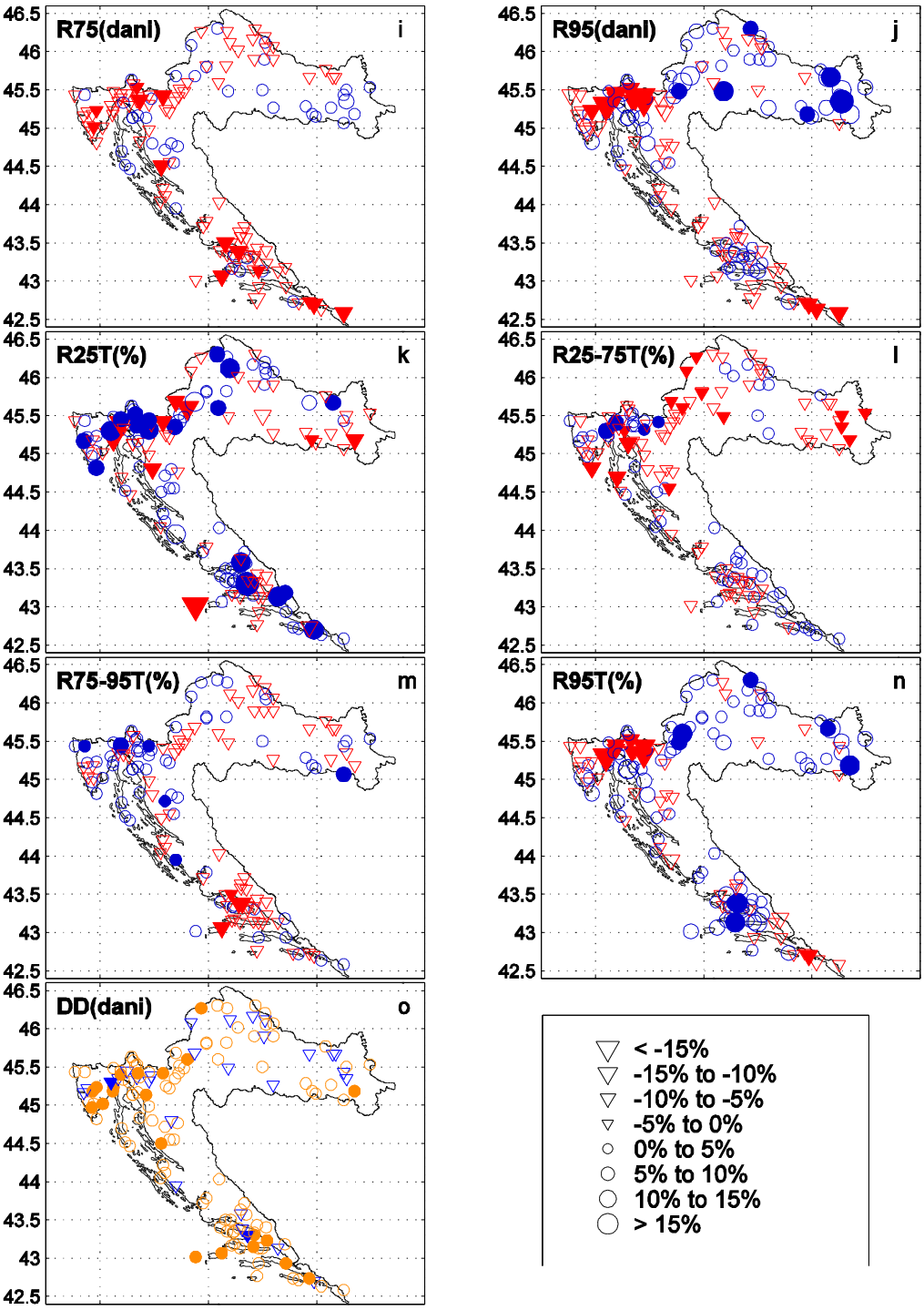

Figure 6.2.2-1. cont.

6.2.3. Dry and wet spells

In this section the annual and seasonal time trends in maximum lengths of dry and wet spells in Croatia are presented. They are defined as consecutive dry/wet days (CDD, CWD) having daily precipitation less/higher than the given threshold: 1 mm and 10 mm. These categories will be abbreviated in the rest of the text with CDD1, CDD10, CWD1 and CWD10 respectively for dry and wet spells. Daily data set comprises the 50-years time period 1961-2010. Spells beginning in one season but extending to the next one are accounted for in the season in which they started. The obtained trends are quantified as changes per decade, expressed as percentages of the associated 1961-1990 means (%/dec).

The most prominent feature of time trend is found for dry spells during autumn (SON) for which a spatially consistent statistically significant negative trend is found (Fig. 6.2.3-1). Decrease ranges from -14%/dec to -1%/dec of associated mean length in CDD1; and from -11% to 5% of CDD10. For the rest of the seasons trends in dry spells of both categories are less consistent in magnitude and direction. Nevertheless, an increase in their lengths is particularly expressed in spring (MAM) at northern Adriatic and its hinterlands (from 7%/dec to 12%/dec); while in summer (JJA) this feature is extended to the southern Croatian coast reaching the increase up to 24% of the climatological mean value for the CDD1. There is also an evidence of increase in CDD1 duration in the eastern Slavonia (4%/dec to 7%/dec) during summer. Winter season (DJF) does not reveal significant changes in dry spell durations. The seasonal trend patterns of CDD1 result with a heterogeneous distribution of the associated annual trend. Though, annual maximum dry spell durations of CDD10 are prone to increase along Adriatic coast and highlands, and to decrease in the continental inland. It my be associated by the significant increase in very wet days (R95) that is found in the inland of Croatia thus breaking duration of dry spells (see chapter 6.2.2).

Regarding the wet spell durations there is not found a consistent spatial trend feature as for CDD (Fig. 6.2.3.-2). There is yet a tendency to CWD1 increase during summer (up to 8%/dec) and autumn (up to 6%/dec) in the eastern lowland and NW region. In the same seasons the CWD1 in northern Adriatic are prone to decrease (up to -12%/dec). In winter season the trend results are mainly mixed in signs and only in the Nw inland there is an evidence of the significant CWD1 increase (up to 15%/dec).

Trends in CWD10 show statistically significant positive trend in the eastern lowland during autumn (11%/dec). Together with the observed significant decrease in CDD10 these results reveal the overall tendencies to the wetter conditions in that region. During summer there is a negative tendeny of CWD10 duration along northern and middle Adriatic and the highlands (-8%/dec to -11%/dec), but positive on the southernmost region (up to 15%/dec). Generally, there is a high spatial heterogeneity found in trend signs of CWD10.

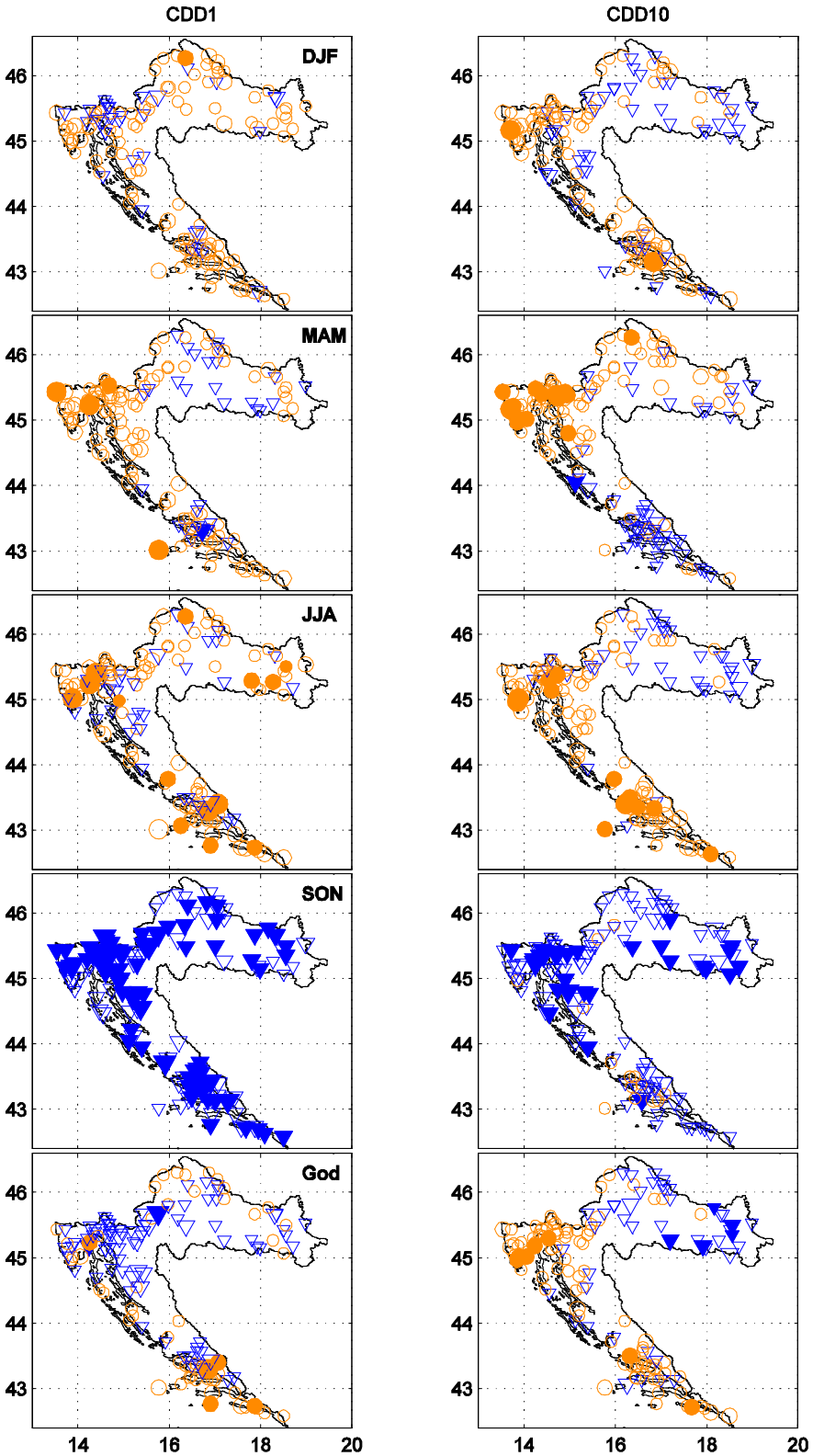

Figure 6.2.3-1. Trend results for maximum dry spell durations for 1 mm and 10 mm thresholds (CDD1, CDD10), for four seasons (upper four rows) and for whole year (bottom row). Circles denote positive trends, triangles the negative one, whereas solid symbols depict statistically significant trend. Blue colour indicates wetter conditions and orange drier. Three sizes of symbols are proportional to the absolute value of change per decade relative to the associated 1961-1990 mean durations: 1-5%, 5-10% 10-30% and >30%, respectively.

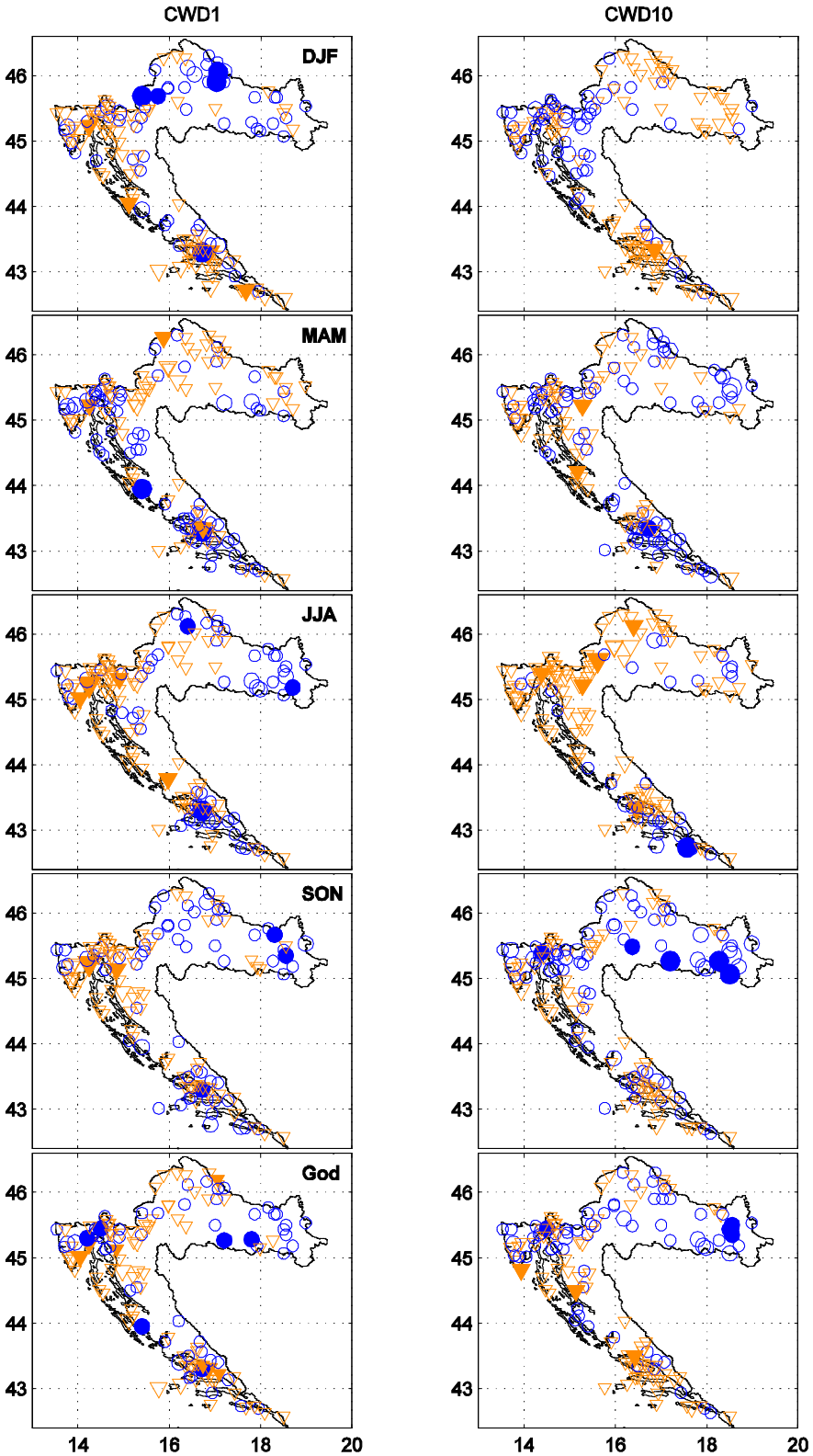

Figure 6.2.3-2. Trend results for maximum wet spell durations for 1 mm and 10 mm thresholds (CWD1, CWD10), for four seasons (upper four rows) and for whole year (bottom row). Circles denote positive trends, triangles the negative one, whereas solid symbols depict statistically significant trend. Blue colour indicates wetter conditions and orange drier. Three sizes of symbols are proportional to the absolute value of change per decade relative to the associated 1961-1990 mean durations: 1-5%, 5-10% 10-30% and >30%, respectively.

6.2.4. Water balance components

Six water balance components can be considered: precipitation amount, potential and real evapotranspiration, loss from and recharge moisture into the soil, run-off and soil moisture amounts within a surface of one metre deep layer of the soil. As described in Pandžić et al. (2008), 10-day water balance components have been calculated according to modified Palmer's (1965) procedure, where modified Eagleman's (1967) procedure has been applied for calculation of 10-day potential evaporation. All water balance components are represented in the same units i.e. in millimetres (mm) what is a equivalent to a litre per square metre.

From the Figure 6.2.4-1 it is visible that there are increasing trends for annual potential evapotranspiration with patterns very similar to those of air. This can be explained by a strong relationship between air temperature and potential evapotranspiration. According to trend lines an increase of annual potential evapotranspiration up to 30% can be expected until middle of 21 century. It means, even in the case that precipitation amounts will stay at the same level as nowadays an increase of potential evapotranspiration can reduce other water balance components for a significant amount. Real evapotranspiration amount trends as well as trend of recharge into the soil are weaker than that for potential evapotranspiration. An extrapolation of the of potential evapotranspiration results for Zagreb-Grič on other meteorological stations, including those on coastal region, can be made thanks to a rather high correlation between time series of potential evapotranspiration for the wider territory of Croatia (Pandžić et al., 2008).

It is obvious from the Figure 6.2.4-2 that there is very strong negative trend for the run-off calculated by Palmer's procedure for Zagreb-Grič meteorological station. According to trend line estimation until the mid-21st century, run-off calculated by Palmer's procedure, will disappear. The results are alarming although "prognostic" power of the trend line is poor and we hope this will not happened. A high correlation exists between calculated run-off for Zagreb-Grič and those for other meteorological stations in the area what has been shown by Pandžić at al. (2008). Thus, somehow results for meteorological stations with shorter time series of run-off can be extrapolated in the past according to the results for Zagreb-Grič meteorological station. It was also shown that some areas in Croatia are more sensitive to global warming than other, which depends on the ratio between potential evapotranspiration and precipitation. In general, in the areas where the precipitation amount is much higher than potential evapotranspiration, an increase in potential evapotranspiration will not considerably affect other water balance components including run-off. More sensitive will be the areas where precipitation amounts are similar to those of potential evapotranspiration.

Annual distribution of precipitation amounts is also very important for other water balance components. As potential evapotranspiration is more sensitive on air temperature changes during warmer than colder part of a year, the areas with maximum precipitation amounts during warmer part of a year will be more sensitive on global warming than those with maximum precipitation during colder part of the year.

Soil moisture trend indicates a reduction of soil moisture in next half century (Figure 6.2.4-3). Regional sensitivity on soil moisture variability and trends depends also on soil type i.e. its field capacity which is in general in coastal region rather small on average.

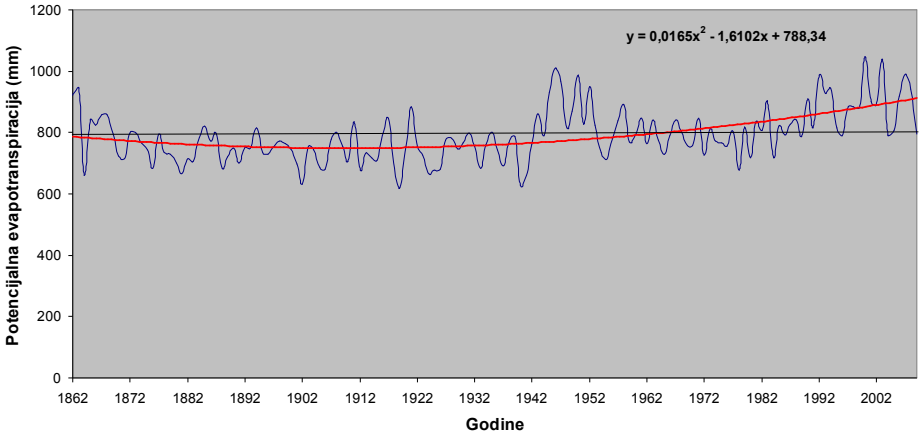

Figure 6.2.4-1. Annual potential evaporation (in millimetres) for Zagreb-Grič meteorological station for the period 1862-2008. Thin line represents an average for the period 1961-1990 (Pandžić and Trninić, 2010)

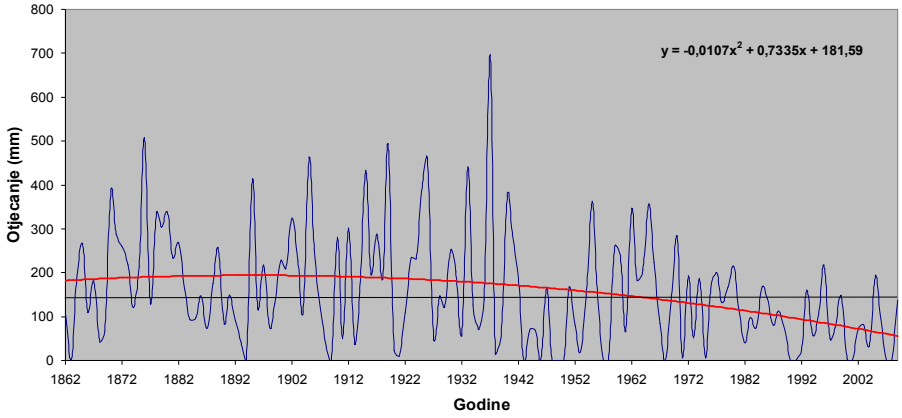

Figure 6.2.4-2 Calculated annual run-off (in millimetres) for Zagreb-Grič meteorological station for the period 1862-2008. Thin line represents an average for the period 1961-1990 (Pandžić and Trninić, 2010)

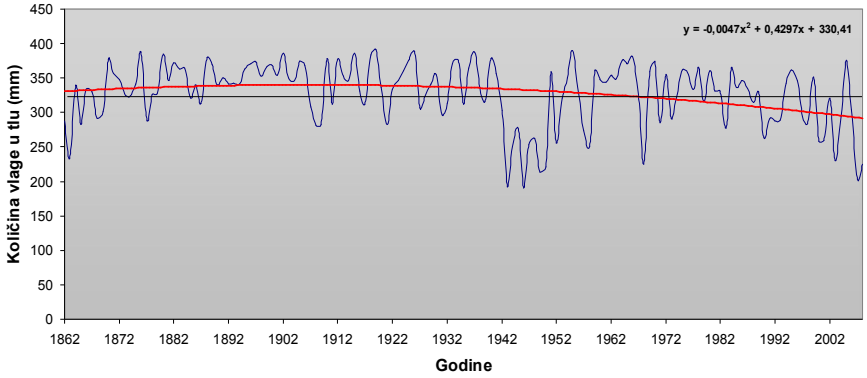

Figure 6.2.4-3. Calculated average annual soil moisture (in millimetres) for Zagreb-Grič meteorological station for the period 1862-2008. Thin line represents an average for the period 1961-1990 (Pandžić and Trninić, 2010)

6.2.5. Decadal climate summary for Croatia

For WMO study in 2013 is used a data set of 11 meteorological stations (Osijek, Varaždin, Zagreb-Grič, Ogulin, Gospić, Knin, Rijeka, Zadar, Split-Marjan, Dubrovnik and Hvar). Distribution of meteorological stations is rather homogeneous over territory of Croatia. Five decadal periods are analyzed, beginning with the decade 1961-1970 until the last 2001-2010. Absolute daily maximum and minimum air temperatures and daily precipitation amounts have been considered. From the Table 6.2.5-1 is visible that Knin is the warmest town in Croatia and Gospic the coldest. Thus, in the period considered absolute minimum temperature of -28.9°C was observed in Gospić, while maximum air temperature of 41.4 °C was observed in Knin. It should be mentioned that at meteorological stations that are not considered here slightly higher maximum, above 42°C, and lower minimum, less than -30°C, have been observed. The lowest minimum temperature is registrated in decade 1961-1970 while the highest maximum temperature is registrated during decade 1991-2000. The highest daily precipitation of 352.2 mm has been observed in Zadar in 1986.

Spaceous decadal averages of air temeparture have been calculaed as arithmetic means of decadal air temeparatures for 11 meteorological. The results are shown in table 6.2.5-2. It is visible that the lowest average decadal spaceous air temperature is for decade 1971-1980 only for 0.1 lower than that for decade 1961-1970 when the air temperature was the same as 1961-1990 average. For the period 1981-1990 a slight increase of temperatue appeared, while during the next two decates an increase have been considerable, i.e. 0.6 °C and 1.0°C respectively, in respect to referent period 1961-1990, which is in accordance with globale decadal averages.

Table 6.2.5-3 shows the ranking of annual spatial averages for the period 2001-2010. The hottest year 2007 was for 1.5 ° C warmer than the mean of the standard period 1961-1990., the coldest year 2005 was 0.1 ° C colder. During the decade 2001-2010, spatial mean air temperature in nine years was higher than the corresponding referent averages.

Table 6.2.5-1 Daily extremes per decade for Croatia for the period 1961-2010

Period	Parameter	value	date	Station name	Coordinates	
					Lat	Lon
1961-1970	Highest Maximum Temperature (°C)	38,6	11.7.1968.	Osijek	45° 28` 24``	18° 48` 23``
	Lowest Minimum Temperature (°C)	-28,9	15.1.1963.	Gospic	44° 33` 2``	15° 22` 23``
	Maximum 24-hr rainfall (mm)	189,2	15.9.1967.	Rijeka	45° 20` 13``	14° 26` 34``
1971-1980	Highest Maximum Temperature (°C)	38,4	5.8.1980.	Knin	44° 2` 27``	16° 12` 25``
	Lowest Minimum Temperature (°C)	-24,8	21.2.1978.	Osijek	45° 28` 24``	18° 48` 23``
	Maximum 24-hr rainfall (mm)	210,3	1.9.1976.	Rijeka	45° 20` 13``	14° 26` 34``
1981-1990	Highest Maximum Temperature (°C)	39,6	3.8.1981.	Knin	44° 2` 27``	16° 12` 25``
	Lowest Minimum Temperature (°C)	-27,3	12.1.1985.	Gospic	44° 33` 2``	15° 22` 23``
	Maximum 24-hr rainfall (mm)	352,2	11.9.1986.	Zadar	44° 7` 48``	15° 12` 21``
1991-2000	Highest Maximum Temperature (°C)	41.4	22.8.2000.	Knin	44° 2` 27``	16° 12` 25``
	Lowest Minimum Temperature (°C)	-26,4	26.1.2000.	Gospic	44° 33` 2``	15° 22` 23``
	Maximum 24-hr rainfall (mm)	200	19.10.1998.	Rijeka	45° 20` 13``	14° 26` 34``
2001-2010	Highest Maximum Temperature (°C)	40,9	19.7.2007.	Knin	44° 2` 27``	16° 12` 25``
	Lowest Minimum Temperature (°C)	-27,6	13.1.2003.	Gospic	44° 33` 2``	15° 22` 23``
	Maximum 24-hr rainfall (mm)	161,4	23.11.2010.	Dubrovnik	42°3 8` 41``	18° 5` 6``

Table 6.2.5-2 Decadal air temperature for Croatia for the period 1901-2010

Decade	Mean Temperature (°C)	Anomaly with respect to 1961-1990 (°C)
1901-1910	NA	NA
1911-1920	NA	NA
1921-1930	NA	NA
1931-1940	NA	NA
1941-1950	NA	NA
1951-1960	NA	NA
1961-1970	12,7	0
1971-1980	12,6	-0,1
1981-1990	12,8	0,1
1991-2000	13,3	0,6
2001-2010	13,7	1,0

Table 6.2.5-3 Temperature ranking 2001-2010

Ranking 2001-2010	Year	Temperature (C)	Anomaly (°C)
Warmest	2007	14,23	1,53
2	2008	14,2	1,5
3	2009	14,1	1,4
4	2002	14,0	1,3
5	2003	13,9	1,2
6	2001	13,7	1,0
7	2006	13,5	0,8
8	2004	13,23	0,53
9	2010	13,22	0,52
Coldest	2005	12,6	-0,1

6.3. Climate change scenarios

6.3.1. Introduction

Local and regional climate and climate change can be analysed from the results of regional climate models (RCMs) with relatively high horizontal resolution, usually between 10 and 50 km. When compared with global climate models (GCMs) with a coarser horizontal resolution between 100 and 300 km, RCMs allow a detailed description of climate at small scales (like in case of Croatia) which largely depends on local topography, land and sea distribution and the distance from the sea. However, the description of climate and projected climate change by RCMs may not be necessarily better than with GCMs. The results of a RCM depend on the quality of the initial and lateral boundary conditions in the process known as *dynamical downscaling*, whereby a RCM is forced by a GCM or by reanalysis data. A detailed description of the downscaling methods is given in e.g. Giorgi and Mearns (1999) and Rummukainen (2010).

In this report, the results of the future climate change in a broader region of Croatia are discussed for temperature at 2 m (T2m) and precipitation. The results for each parameter are obtained from the two data sources: a) from dynamical downscaling by the RegCM RCM made at the Croatian Meteorological and Hydrological Service (DHMZ) for the IPCC A2 scenario (Nakićenović et al. 2000) and b) from dynamical downscaling of various RCMs that participated in the European project ENSEMBLES (van der Linden and Mitchell 2009, Christensen et al. 2010) for the IPCC A1B scenario.

The DHMZ downscaling simulations with the RegCM model (model details are given in Pal et al. 2007) are made for the European region at a 35-km horizontal resolution. RegCM was forced every 6 hr by the lateral boundary conditions obtained from the ECHAM5/MPI-OM GCM (Roeckner et al. 2003).

The results from the ENSEMBLES project relate to different RCMs forced by different GCMs. Such a multi-model approach allows an analysis of sources of uncertainty in projections of the future climate (Hawkins and Sutton 2009**,** Déqué et al. 2012). In this report, the 18 combinations of various RCMs forced by various GCMs are analysed (Table 6.3.1-1). The description of the ENSEMBLES models and experiments are available from Christensen et al. (2010; their Table 1 and Fig. 1) in and from Déqué et al. (2012).

Tablica 6.3.1-1. Analysed regional climate models (RCMs), organisations which performed simulations and sources of the boundary conditions. All models take part in the comparison between the periods P0 and P1. In the italics are the models that are not compared for the periods P0 and P2 and for the periods P0 and P3. In the bold print are the models that have been analysed in Branković et al. (2013). For acronyms and detailed description of models see Christensen et al. (2010) and Déqué et al. (2012).

	Regional climate model	Organisation	Global climate model that provides boundary conditions
1.	RCA3	C4I	HadCM3Q16
2.	RM5.1	CNRM	HadCM3Q1
3.	HIRHAM5	DMI	ARPEGE
4.	**HIRHAM5**	**DMI**	**ECHAM5**
5.	HIRHAM5	DMI	BCM
6.	CLM	ETHZ	HadCM3Q0
7.	**RegCM3**	**ICTP**	**ECHAM5**
8.	**RACMO2**	**KNMI**	**ECHAM5**
9.	HadRM3Q0	MetoHC	HadCM3Q0
10.	HadRM3Q16	MetoHC	HadCM3Q16
11.	HadRM3Q3	MetoHC	HadCM3Q3
12.	**REMO**	**MPI-M**	**ECHAM5**
13.	RCA3	SMHI	BCM
14.	**RCA3**	**SMHI**	**ECHAM5**
15.	RCA3	SMHI	HadCM3Q3
16.	HIRHAM	Met.No	BCM
17.	HIRHAM	Met.No	HadCM3Q0
18.	PROMES	UCLM	HadCM3Q0

6.3.2. Methodology

The climate changes for T2m and precipitation in the DHMZ RegCM downscaling simulations are analysed as the differences of seasonal means from the two periods: the period 1961-1990 represents the climate of the 20th century or the "present" climate (from now on in the text and in figures this period is denoted as P0) and the near future period 2011-2040 (denoted as P1). P0 represents a standard 30-year climatic period according to the World Meteorological Organisation standards (WMO 1988). The climate change is defined as a difference between the future and present climate. Both present and future climates are computed as ensemble means of

the three different RegCM realisations that differ only in the ECHAM5/MPI-OM initial conditions. Despite having at our disposal three-member ensembles, the deficiency of this analysis is the use of the initial and boundary conditions from only one GCM.

In the ENSEMBLES downscaling simulations, the present climate is also defined for the period 1961-1990 (P0) in which the RCMs were forced by the GCMs that included the observed concentrations of the greenhouse gases (GHGs). For the future climate (in the 21st century) the RCMs results are split into three periods: 2011-2040 (P1; same as the DHMZ simulations), 2041-2070 (P2) and 2071-2099 (P3). The climate change in the three future periods is computed as the differences between the 30-year means: P1-P0, P2-P0 and P3-P0. We discuss the differences of the ensemble means – in each period, the climatological fields are first averaged across the ensemble of all models and then the averages from the two different periods are subtracted. Since in the periods P2 and P3 fewer model simulations were available than for P1, the corresponding P0 contains only those models that are present in P2 and P3. Additionally, the consistency among models in every grid point on the common grid (approximately 25 km) is ascertained if the same sign of climate change as in the difference between the ensemble means is simulated by the two thirds of all the models considered (e.g. IPCC 2007). When discussing the results for the Croatian coast we refer in addition to the results of Branković et al. (2013) where the subset of the ENSEMBLES simulations was analysed (five RCMs forced by the ECHAM5/MPI-OM GCM; Roeckner et al. 2003). Statistical significance of the climate change in Branković et al. (2013) study was determined using the Wilcoxon-Mann-Whitney nonparametric test (Wilks 2006).

For both the DHMZ and ENSEMBLES models, the results for four climatological seasons are presented and discussed: winter (December-February; DJF), spring (March-May; MAM), summer (June-August; JJA) and autumn (September-November; SON).

6.3.3. Results

6.3.3.1. Temperature at 2 m (T2m)

(a) DHMZ RegCM simulations

The mean seasonal near-surface temperature (T2m) over Europe is projected to increase in the period 2011-2040 (P1) in the range between 0.2°C and 2°C (Fig. 6.3.1-1). This increase will not, however, be uniform in all seasons. The smallest increase, between 0.2 – 0.4°C, is expected in spring (Fig. 6.3.1-1b) over a large part of central Europe with a little larger warming over the Iberian Peninsula (up to 0.6°C) and at the eastern border of the integration domain (up to 0.8°C). A relatively uniform increase of T2m of around 0.4°C is expected in winter over a large part of the integration domain, but over northeastern Europe and northwestern part of Africa the temperature increase is projected to be up to 1°C (Fig. 6.3.1-1a). The largest warming of around 2°C is expected in the summer over the Iberian Peninsula and western Africa (Fig. 6.3.1-1c). The temperature increase in the autumn is projected to have similar pattern as in the summer but with smaller amplitude (maximum up to 1.2°C, Fig. 6.3.1-1d). The above temperature changes are statistically significant at the 95% confidence level in all seasons and in almost entire domain; the only exception is the T2m rise in spring over central Europe and the Atlantic.

From the simulated climate changes over Europe, the following projection for the Croatian region can be inferred: the largest change in T2m is expected to be in the summer with an

increase around 0.8°C in Slavonia, 0.8-1°C in the central part of Croatia, the Istrian Peninsula and across the interior of the Adriatic coast and at the central and southern Adriatic. The largest temperature increase, around 1°C, will be at the Adriatic coast and the northern Adriatic islands. The expected warming will be around 0.8°C in the autumn, and between 0.2-0.4°C in winter and spring.

The change in the amplitude of extreme temperatures in the future climate (Fig. 6.3.1-2) will be more pronounced than the change of the mean seasonal T2m (Fig. 6.3.1-1). In the winter, the increase of the mean minimum T2m is projected to be around 0.4°C over a larger part of the domain, in some parts of the Alpine region and in the southern parts of the domain up to 0.6°C, whereas in the northeastern part of domain (Russia) the mean minimum T2m may increase even up to 1.4°C (Fig. 6.3.1-2a). The change of the mean maximum temperature in the summer (Fig. 6.3.1-2b) will have the pattern similar to the change of the mean summer T2m (Fig. 6.3.1-1c), but the amplitude of warming is expected to be larger than that for the mean T2m. The largest warming is expected over the central Iberian Peninsula where the mean maximum temperature in the period P1 could be 2°C higher than the mean maximum temperature in the present climate. The projected changes in the mean minimum T2m during the winter and in the mean maximum T2m during the summer are all statistically significant at the 95% confidence level over the whole integration domain.

In large part of Croatia, the winter minimum T2m is expected to increase up to 0.5°C, however, a smaller increase may be expected only in the Dalmatian hinterland (Fig. 6.3.1-2a). The summer maximum temperature may increase up to around 0.8°C in the continental Croatia and a little more than 1°C along the Adriatic coast (Fig. 6.3.1-2b).

The number of cold and warm days was analysed from the RegCM simulations of the present climate and compared with the observational data at the Croatian meteorological stations. However, since extreme events are largely influenced by local small-scale geophysical characteristics, the regional climate models may have difficulties in simulating extreme parameters because models' horizontal resolution may be too coarse.

Figure 6.3.1-3a shows that during the winter the RegCM model underestimates the number of cold days (that is the number of days when the minimum temperature is colder than 0°C) in the continental Croatia but overestimates at the coast. In the northern part of Croatia, the observed mean number of the winter cold days for the present climate is over 60 days, whereas the model estimate is less than 50 days. The largest discrepancy between the simulated and observed data is seen in the area close to the Adriatic coast. Here, the steep orography and the local geophysical characteristic are not well represented by the model's 35-km resolution and cause the differences with respect to the observational data. In spite of such a deficiency in our model simulations, it can be concluded that the model was able to represent reasonably well the observed differences in the number of cold days between the continental and coastal parts of Croatia. The number of cold days in the future climate is projected to decrease for about 10% in the northern parts of Croatia and about 5% in the coastal area (Fig. 6.3.1-3b). This decrease is consistent with an increase of the minimum T2m over the whole of Croatia.

The RegCM model also underestimates the mean number of warm days in the present climate (Fig. 6.3.1-3c). Generally, the simulated number of warm days is halved when compared with the observed number of warm days at the Croatian stations. This discrepancy is partly due to the model systematic errors and partly due to misrepresentation of vegetation in the areas close to

the coast. In the near future, an increase in the number of warm days is expected: by 3-4 days in the northern Croatia and up to 10 days at the coast. (Fig. 6.3.1-3d). This increase is between 10-15% relative to the number of warm days in the present climate and it is consistent with the expected increase of maximum T2m

(b) The ENSEMBLES simulations

The ENSEMBLES RCM simulations of the first future 30-year period (P1) indicate an increase of T2m in all seasons with the amplitude typically between 1°C and 1.5°C. A somewhat higher warming, between 1.5°C and 2°C, is projected over the eastern and central parts of Croatia during winter (Fig. 6.3.1-4a) and over central and southern Dalmatia during summer (Fig. 6.3.1-4c). On the monthly timescale, even a decrease of the mean temperature amounting to -0.5°C may be possible, primarily as a consequence of internal variability of the climate system (Hawkins 2011; Branković et al. 2013; their Fig. 10).

For the period around the middle of the 21st century (P2), the projected winter warming over the continental Croatia is between 2.5°C and 3°C and a slightly reduced increase of T2m is projected over the coastal areas (Fig. 6.3.1-5a). In the summer, the increase of T2m over central and southern Dalmatia is expected to be between 3°C and 3.5°C, but for the other parts of Croatia a T2m increase of between 2.5°C and 3°C is projected (Fig. 6.3.1-5c). In other two seasons the expected T2m increase is spatially homogeneous similar to projections for the first part of the 21st century and equals to between 2°C and 2.5°C (not shown). These results are similar to those obtained directly from the ensemble mean of the ECHAM5/MPI-OM GCM for the period P2, 2041-2070 (Branković et al. 2010). The largest differences in the temperature increase between the global and regional models is seen in the summer over the northern Adriatic when the ECHAM5/MPI-OM GCM indicates the warming of over 3.5°C; a somewhat weaker warming is expected in the central and southern parts of the Adriatic.

For the end of the 21st century (period P3), the projections by ENSEMBLES' RCMs include very high T2m increase. Also, the differences between the spring and autumn seasons are higher than in the earlier periods of the 21st century. During the winter, the T2m increase between 3.5°C and 4°C is projected over the continental Croatia and a somewhat reduced T2m increase is simulated for the coastal area – between 3°C and 3.5°C (Fig. 6.3.1-5b). The projected summer warming is very high and equals to between 4.5°C and 5°C over the southern and central Dalmatia and between 4°C and 4.5°C over other parts of Croatia (Fig. 6.3.1-5d). In some models, the increase of the monthly mean temperature higher than 5°C may be possible in the coastal area during the summer (e.g. the RACMO2 and REMO RCMs in Branković et al. 2013; their Fig. 10). In other two seasons, the T2m increase is spatially homogeneous over the whole Croatia and equals to between 3°C and 3.5°C during spring and between 3.5°C and 4°C during autumn (not shown).

More than the two thirds of all ENSEMBLE models agree in the sign of projected changes and simulate the T2m increase in all seasons to be at least 0.5°C higher in the whole 21st century than in the present climate. Standard measures of statistical significance suggest a possibility of significant T2m change even in the first part of the 21st century (Branković et al. 2013).

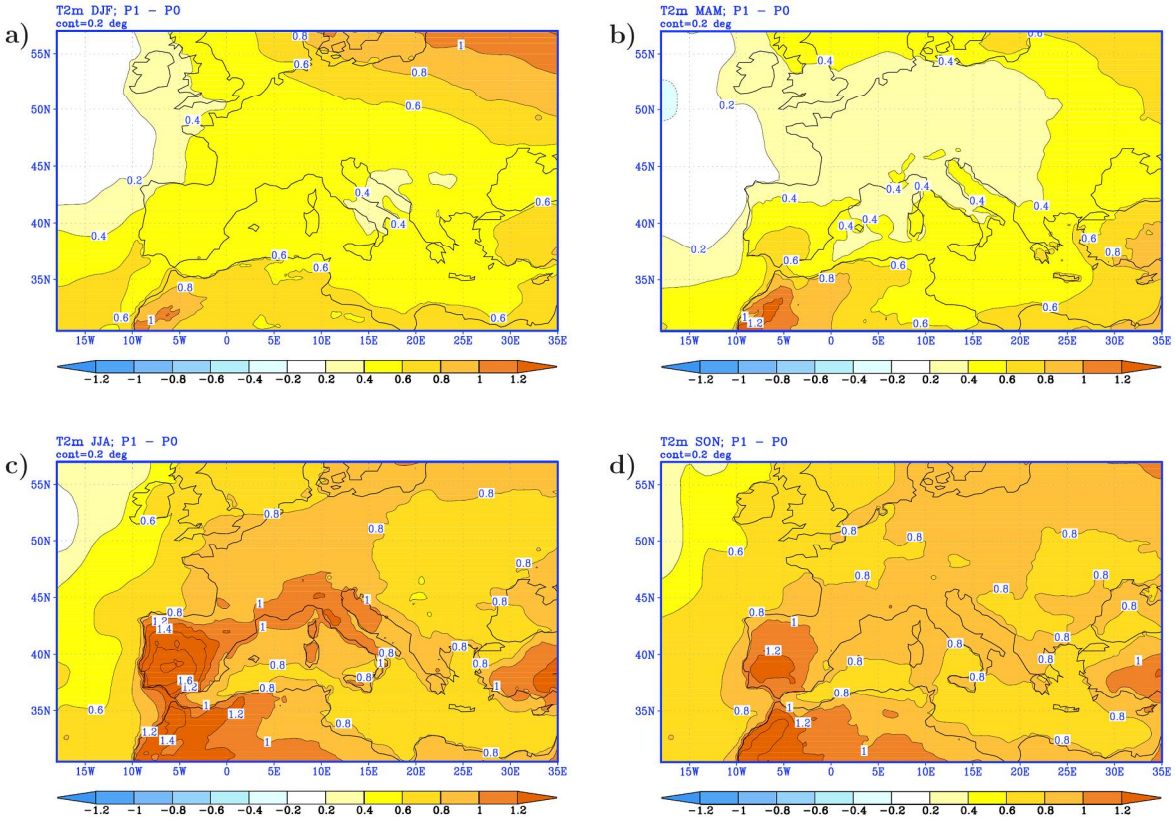

Figure 6.3.1-1. Ensemble-mean difference of temperature at 2 m (T2m), P1 minus P0: a) winter, b) spring, c) summer, d) autumn. Contours every 0.2 °C.

a)

b)

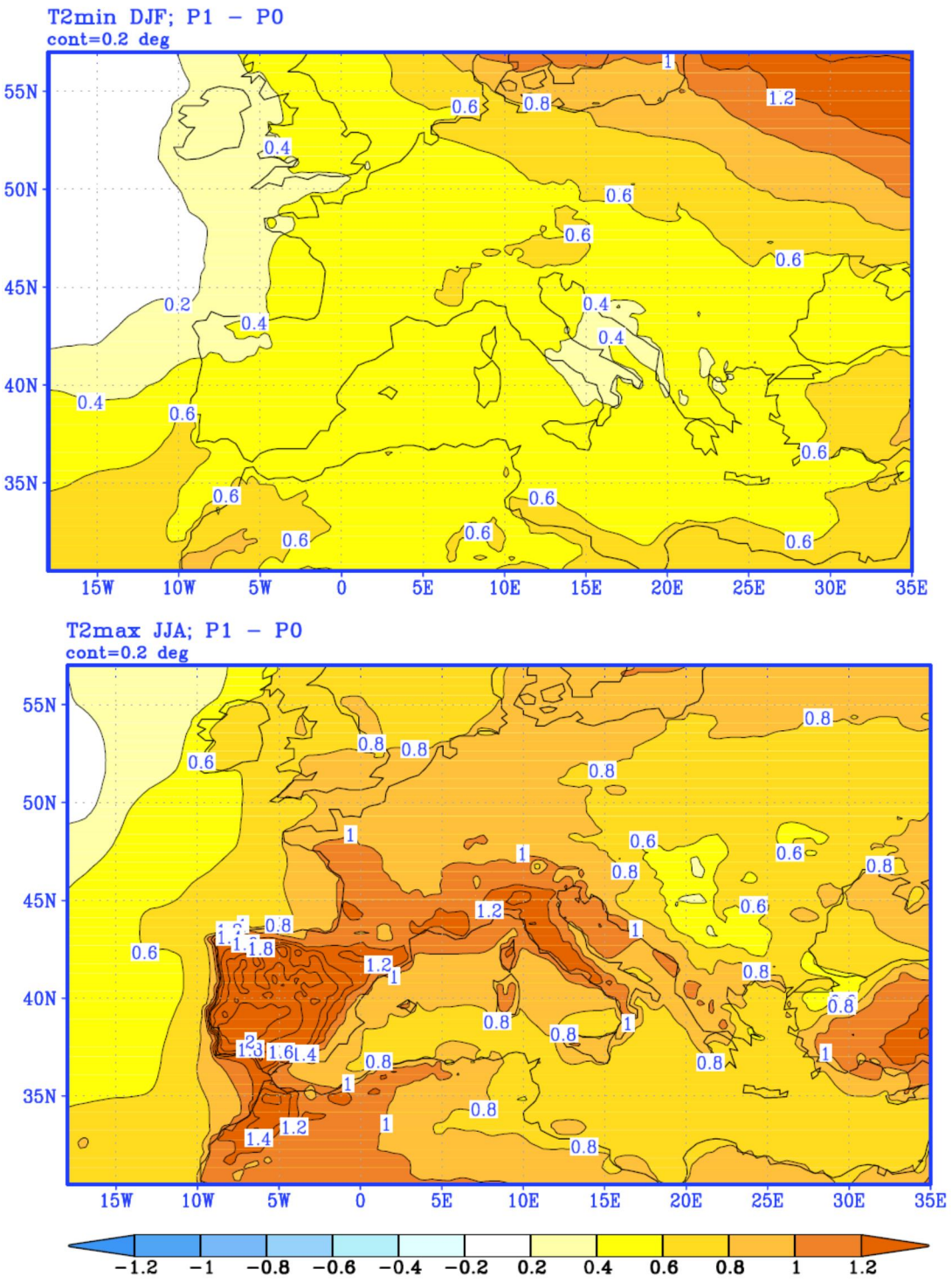

Figure 6.3.1-2. Ensemble-mean difference for: a) minimum T2m in the winter, b) maximum T2m in the summer, P1 minus P0. Contours every 0.2 °C.

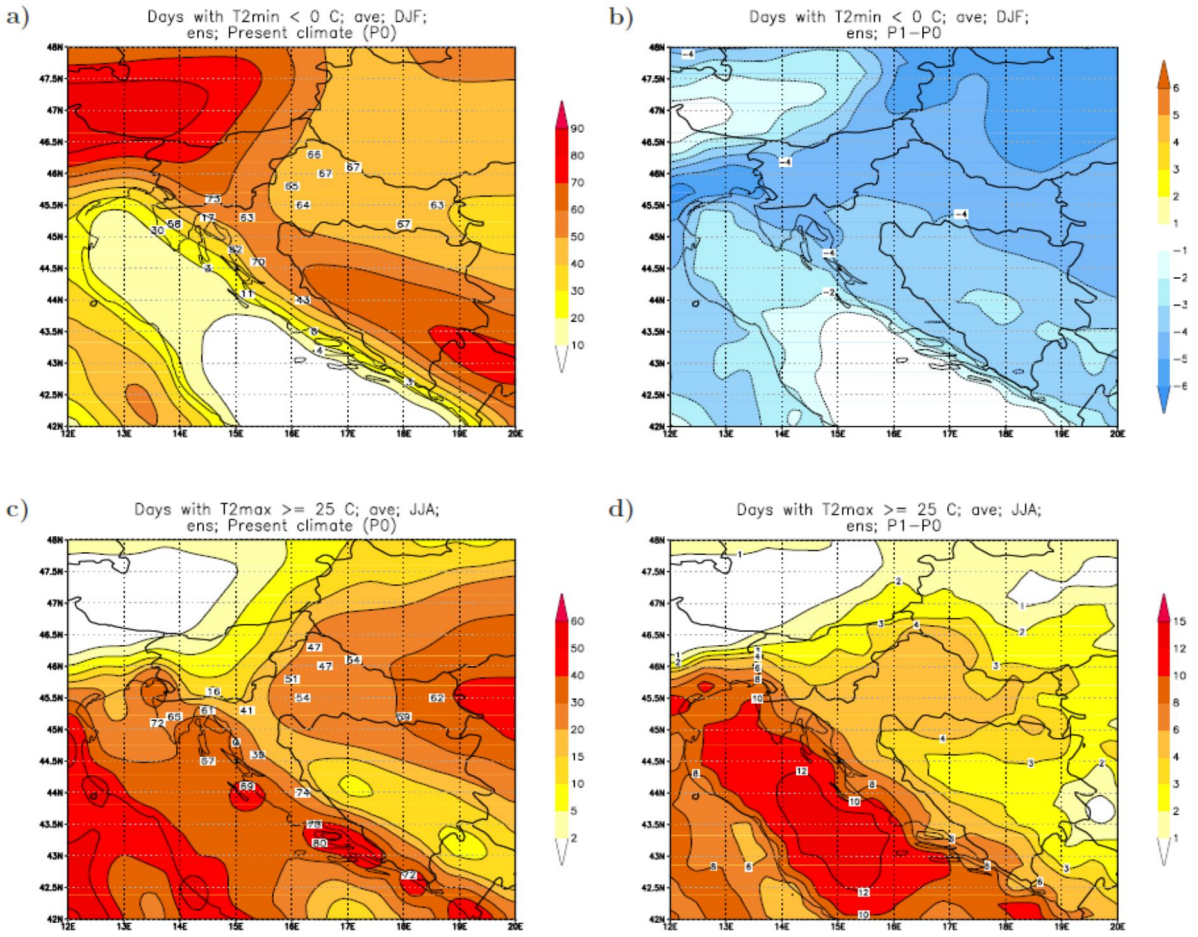

Figure 6.3.1-3. Mean number of cold days in winter for: a) present climate (P0) and b) change in the number of cold days (P1 minus P0). Mean number of warm days in summer for: c) present climate (P0) and d) change of the number of warm days (P1 minus P0). Contours in a) every 10 days; in b) 1 day; in c) 2, 5, 10, 15, 20, 30, 40, 50, 60 and in d) 1, 2, 3, 4, 6, 8, 10, 12, 15 days.

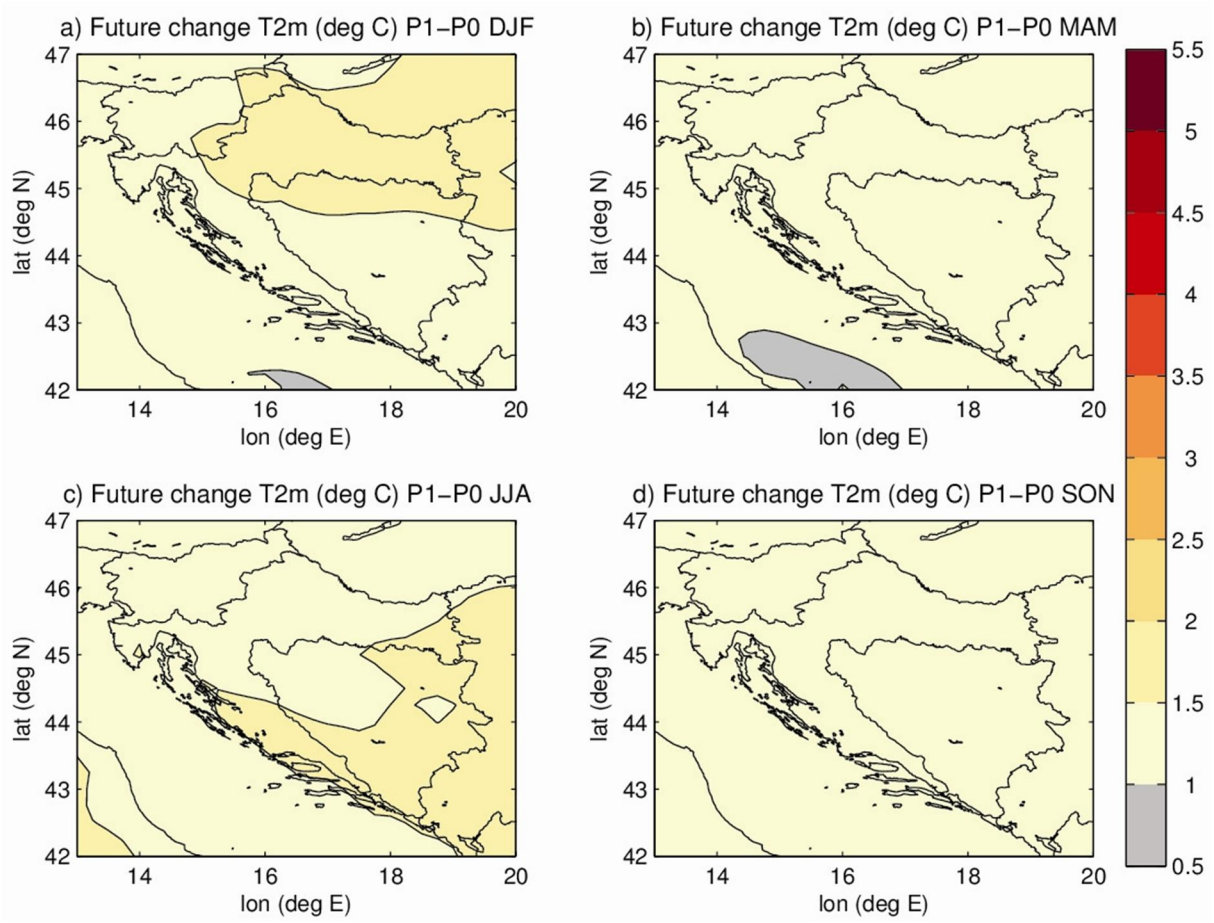

Figure 6.3.1-4. The T2m ensemble-mean difference between the periods P1 and P0: a) winter (DJF), b) spring (MAM), c) summer (JJA) and d) autumn (SON). Units are °C. In all grid points, the sign of change in at least the two thirds of the models agrees with the sign of change in ensemble means

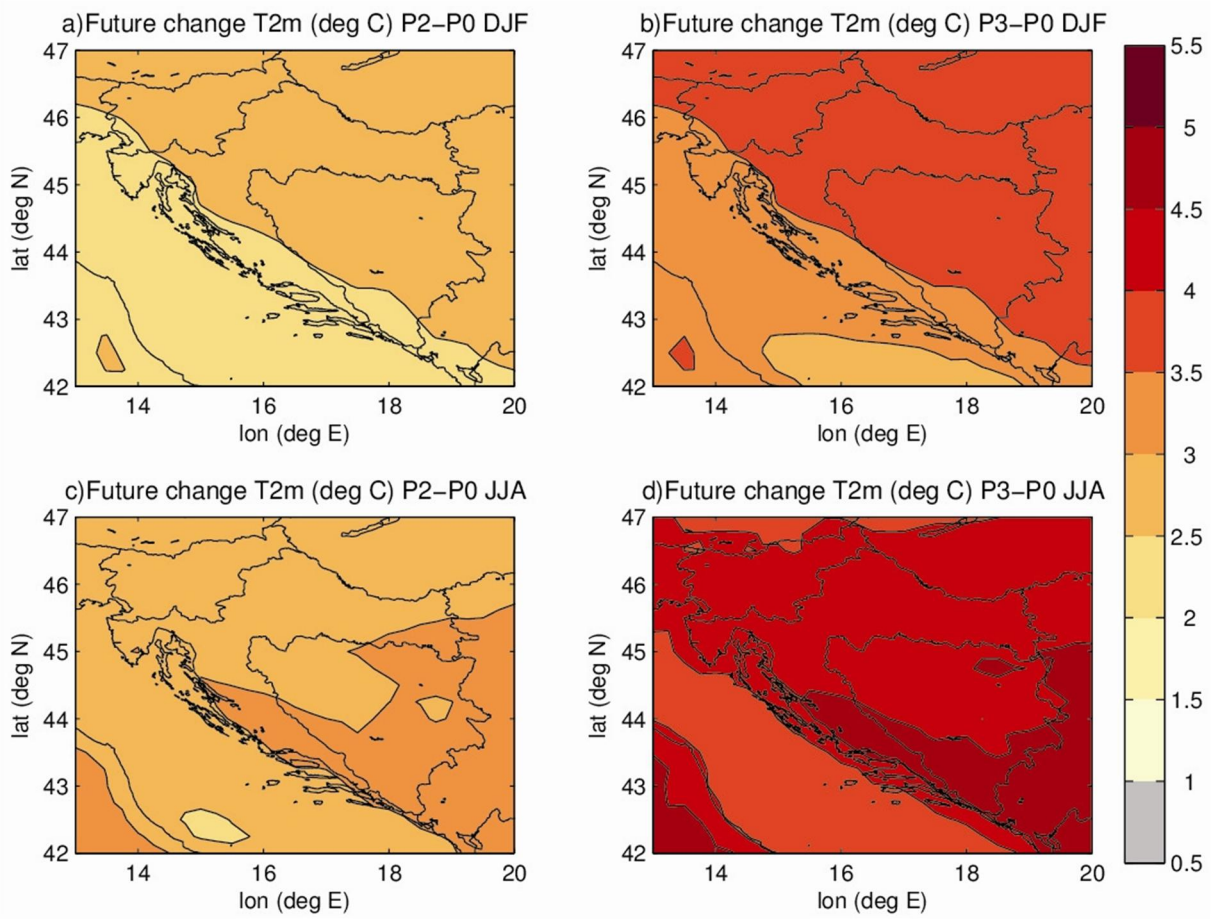

Figure 6.3.1-5. The T2m ensemble-mean difference in winter (DJF) for: a) P2-P0 and b) P3-P0, and in summer (JJA) for: c) P2-P0 and d) P3-P0. Units are °C. In all grid points, the sign of change in at least the two thirds of the models agrees with the sign of change in ensemble means

6.3.3.2. Precipitation

(a) The DHMZ RegCM simulations

Precipitation changes in Croatia in the near future climate (2011-2040; period P1) relative to the reference climate (1961-1990, P0) are analysed for the mean precipitation and indices of precipitation extremes on the seasonal and annual basis, similar to Patarčić et al. 2013 (submitted to Climate Research). The following indices of precipitation extremes are used (Peterson et al. 2001; WMO 2004):

1. dry days (*DD*) – the number of days in a season (year) with daily precipitation (R_d) less than 1.0 mm
2. simple daily intensity index (*SDII*) – seasonal (annual) precipitation amount divided by seasonal (annual) number of wet days ($R_d \geq 1.0$ mm)
3. moderate wet days (*R75*) – the number of days per season/year with precipitation $R_d > R_{75\%}$, where $R_{75\%}$ is the 75th percentile of the distribution of seasonal (annual) daily precipitation amounts in wet days during the 1961-1990 reference period

4. very wet days (*R95*) – same as *R75* but for the 95th percentile of the distribution of seasonal (annual) daily precipitation
5. *R95T* – fraction of seasonal (annual) precipitation occurring during very wet days.

Total precipitation and indices of precipitation extremes from RegCM3 integrations were first calculated from each individual ensemble member for each year (season) and then the average was computed over 30 years (seasons) and over all members. Thus, the results presented in this report refer to the ensemble mean precipitation and indices of precipitation extremes. Statistical significance of the differences between the near-future and reference climate was tested by the Wilcoxon-Mann-Whitney nonparametric rank sum test (Wilks, 2006) at the 95% confidence level.

The largest near-future change in seasonal precipitation is expected in the autumn, when a decrease of precipitation between 2% and 8% is seen over the larger part of Croatia (Fig. 6.3.2-1d). However, in Slavonia, precipitation is projected to increase between 2% and 12%, and more than 12% in the eastern Slavonia where the increase is statistically significant. In other seasons, the model results indicate an increase in precipitation (2%-8%) except in spring (Fig. 6.3.2-1b) over the Istrian Peninsula, Kvarner Bay and the central Adriatic where precipitation is projected to decrease between 2% and 10%. These changes, particularly in the winter and summer, are not spatially consistent, they are smaller in magnitude than in autumn and they are not statistically significant. The decrease in precipitation at the Adriatic coast in the autumn and spring has an overall impact on the annual amounts – over the northern and middle Adriatic precipitation is projected to decrease by 2% to 4% (Fig. 6.3.2-1e). In the eastern part of the continental Croatia, model results indicate an increase of annual precipitation between 2% and 6% which is statistically significant over eastern Slavonia.

An increase in the number of dry days (*DD*) in autumn (1-2 days) is evident over most of Croatia except in the eastern continental parts (Fig. 6.3.2-2a). This increase corresponds to a 1-4% change relative to the reference climate (P0) values. In other seasons, *DD* changes are less than one day (not shown). On the annual basis, changes in *DD* are larger in magnitude than in autumn due to small increases in the number of *DD* in other seasons that contribute to the annual mean (Fig. 6.3.2-2b). Over the northern part of the Istrian Peninsula and in the Dalmatian hinterland, the model results indicate an increase of *DD* up to 4 days and over the northwestern part of Croatia up to 3 days which corresponds to 2% change. In the eastern continental Croatia, however, a decrease from one to three DD (1%) is projected. Since the changes in *DD* (and consequently in wet days) are very small in all seasons (from -1% to 4%), spatial distribution of the changes in *SDII* (Fig. 6.3.2-3) is mostly determined by the future changes in the seasonal and annual total precipitation. An increase in *SDII* is expected in the winter (Fig. 6.3.2-3a) over a larger part of Croatia (1%-6%) and in the spring (Fig. 6.3.2-3b) in the continental part (from 1% to more than 6%). A statistically significant decrease in the spring *SDII* is seen in the northern and central Dalmatia. Changes in the summer *SDII* (Fig. 6.3.2-3c) affect smaller areas than in other seasons with an increase in the eastern Slavonia (1% to 3%), parts of Istria and the northern Adriatic and in the southernmost part of Croatia (1% to 6%). A decrease in the summer *SDII* is projected over southern Dalmatia (1% to 4%) and over the mountainous part of Croatia (more than 4%). Changes in the autumn *SDII* (Fig. 6.3.2-3d) are consistent with the changes in the total precipitation (Fig. 6.3.2-1d) – in the southern part of Croatia a decrease between 1% and 4% is projected, while an increase is seen in eastern Slavonia (from 1% to more than 6%). On the annual basis (Fig. 6.3.2-3e), the *SDII* changes are generally smaller in magnitude than for seasons, ranging from 1% to 3% in the northern Croatia, and from 3% to 5% in the eastern

Slavonia. At the Adriatic coast, the changes in *SDII* are associated with the decreases in the number of wet days or with the decreases in the annual precipitation. The increases in *SDII* are statistically significant in the eastern Slavonia in the autumn and for the year, and also in the part of northern Croatia in the spring and for the year.

The projected changes in the number of seasonal moderate and very wet days (*R75* and *R95*, respectively) are negligible. It is only on the annual basis that a statistically significant increase in *R75* is seen in the eastern continental part of Croatia (1-3 days), and a decrease (1-2 days) is projected over parts of Lika and Dalmatian hinterland (Fig. 6.3.2-4). Although changes in the frequency of *R95* are negligible, the fraction of seasonal and annual precipitation from the very wet days (*R95T*) may change in the near-future climate. The increase in *R95T* between 1% and 4% is projected in the winter (Fig. 6.3.2-5a) along the Adriatic coast and its hinterland, and in the northwestern parts of Croatia. Since the large daily precipitation amounts at the Adriatic coast in the cold part of the year are the result of the long-term precipitation (Zaninović et al. 2008), the winter increase in *R95T* indicates their intensification. In the spring, an increase in *R95T* is projected in the northern Croatia, over parts of the northern Adriatic and in the southernmost part of the coast (Fig. 6.3.2-5b). In the summer, changes in *R95T* are variable in sign and they are spatially less uniform than in other seasons (Fig. 6.3.2-5c). A somewhat larger increase is seen in eastern Slavonia (1%-5%), thus indicating an increase in the short-term heavy precipitation (showers) which dominates over this (continental) region during summer. In the autumn, a decrease in *R95T* is projected along the Adriatic coast (Fig. 6.3.2-5d), while an increase is seen in the northwestern Croatia and eastern Slavonia (more than 6%) where it is statistically significant. On the annual basis (Fig. 6.3.2-5e), *R95T* may significantly increase in eastern Slavonia and along the northern and central Adriatic. Since changes in the frequency of very wet days (*R95*) are generally negligible in all seasons and for the year, the increase in *R95T* is related to the increase in extreme precipitation, and to a lesser extent to the decrease in the total seasonal or annual precipitation.

Previous studies of precipitation changes in Europe and the Mediterranean area, which are mainly focused on changes at the end of the 21st century when the signal of climate change is stronger, suggest an increase in precipitation in northern Europe and a decrease in southern Europe and the Mediterranean area. In the summer, the border line between the above two areas with different sign of changes is shifted more to the north so that the drying affects most of Europe (e.g. Giorgi and Lionello 2008). Branković et al. (2012) showed that, according to the results of the RegCM simulations which were used in this report, the division on the European wetter north and drier south in the winter was already visible in the near-future climate, but with a smaller amplitude than the one that is projected for the end of the 21st century. On the other hand, they concluded that the summer drying in the P1 climatic period over southern Europe and the Mediterranean area was not yet established. Although our results indicate statistically insignificant changes in extreme precipitation, there are some similarities with projected changes in precipitation extremes in the winter for the late 21st century. For example, Kendon et al. (2010) showed that, based on the global model HadAM3P simulations under the A2 scenario, the warming of the atmosphere and the related increase in the atmospheric moisture in winter in most parts of Europe would result in an increase not only in the mean precipitation, but also in daily intensity and extreme precipitation. However, the reduction in the frequency of wet days in the winter (i.e. increase in the number of dry days), which, according to their results, is projected for southern Europe, is not observed in our simulations in the near future. Moreover, the summer drying in the Mediterranean area in the late 21st century, which is associated with an increase in the number of dry days even under the weaker A1B scenario (Lehtonen et al. 2013), is not seen

in our simulations for the period 2011-2040. Our results suggest that the future changes in wet extremes (*SDII* and *R95T*) over Croatia would be more pronounced in terms of magnitude and spatial extent than the changes in dry extreme (*DD*). The described changes in the mean and changes in the extreme precipitation indicate that their spatial extent and magnitude is similar in all seasons except in autumn when the changes in the mean seasonal precipitation dominate.

(b) The ENSEMBLES simulations

In the first part of the 21st century, the total precipitation amount *R* is projected to increase during the winter with the amplitude between 5% and 15% over parts of the northwestern Croatia and the Kvarner region. The sign of these changes agrees in at least the two thirds of all models (Fig. 6.3.2-6a). During summer in the same period, *R* is projected to decreases from -5% down to -15% over large parts of the Dalmatian hinterland and the Croatian highlands (Fig. 6.3.2-6c). This decrease in precipitation is also found in at least the two thirds of the models. The precipitation decrease of the same amplitude is projected for the southern Croatia during spring (Fig. 6.3.2-6b), while during autumn the projected changes are between -5% and +5% (Fig. 6.3.2-6d). Over the coastal and island locations, the projected signal of climate change is spatially and temporally variable and is rarely statistically significant on the monthly timescale (Branković et al. 2013; their Fig. 11).

For the period around the middle of the 21st century (P2), the moderate precipitation changes are projected over a much larger part of Croatia than for the first 30-year long period (P0), especially for the winter and summer seasons. However, the projected winter precipitation increase between 5% and 15% does not exceed the projected changes for the P1 period (Fig. 6.3.2-7a). Somewhat stronger precipitation decrease, between -15% and -25%, is projected for the summer season over almost entire Croatia except the northernmost and westernmost parts where the reduction in precipitation could amount between -5% and -15% of the reference period (Fig. 6.3.2-7c). The projected decrease in precipitation between -15% and -5% during spring is found over the entire coastal area and its hinterland, while during autumn the projected precipitation increase between 5% and 15% is projected over the central and eastern northern lowlands (not shown). Although on the mean monthly timescale and local spatial scales a substantial variability of the projected climate change signal can be expected (Branković et al. 2013; their Fig. 11), the projected changes are present in at least the two thirds of the models.

Changes in seasonal precipitation amounts cover large parts of Croatia also in the last period of the 21st century (P3). As for the P2, the projected increase in the total precipitation during winter between 5% and 15% is seen all over Croatia except the southernmost parts (Fig. 6.3.2-7b). Thus, the ENSEMBLES models do not indicate a substantial difference in the projected winter precipitation increase between the periods P2 and P3. However, the projected decrease in the total precipitation during summer in P3 points to a larger precipitation reduction than in P2. Over the central and eastern parts of Croatia and Istria, the projected precipitation decrease is expected to be between -15% and -25%, while in the Croatian highlands and in the most parts of the northern Adriatic and its hinterland the projected decrease could be between -25% and -35% (Fig. 6.3.2-7d). In some models even stronger reduction of the projected summer precipitation is found (to approximately -60% in RACMO2 and HIRHAM5 RCMs in Branković et al. 2013; their Fig. 11). The reduction in precipitation between -5% and -15% in the coastal area and in the hinterland is projected also for spring and autumn (not shown). As for the previous period, the projected changes are present in at least the two thirds of the models.

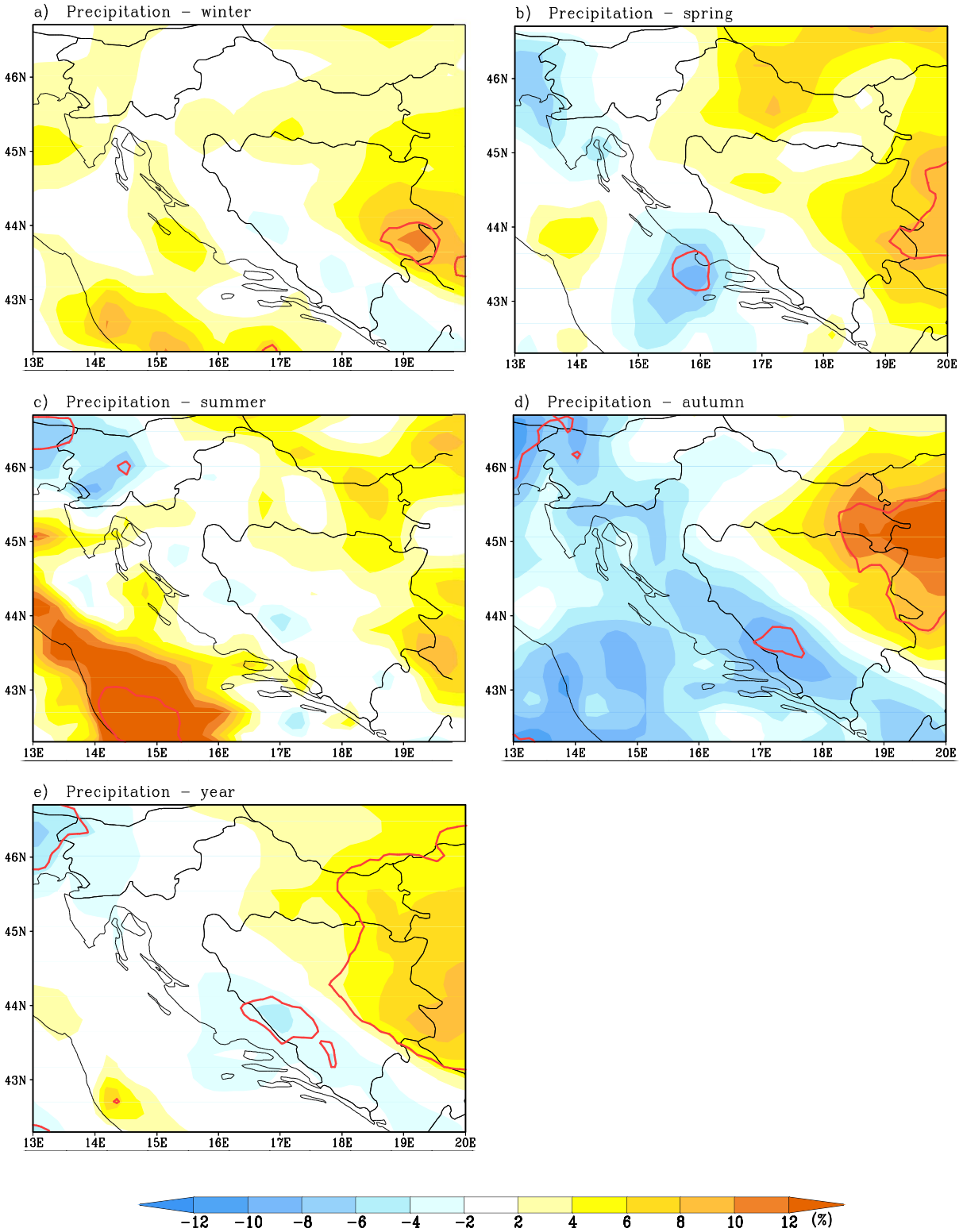

Figure 6.3.2-1. The near-future (2011-2040; period P1) change in seasonal (a-d) and annual (e) total precipitation relative to the reference period (1961-1990; P0). Changes are expressed as the percentages of precipitation in the reference period. Statistically significant changes at the 95% confidence level are denoted by red contour.

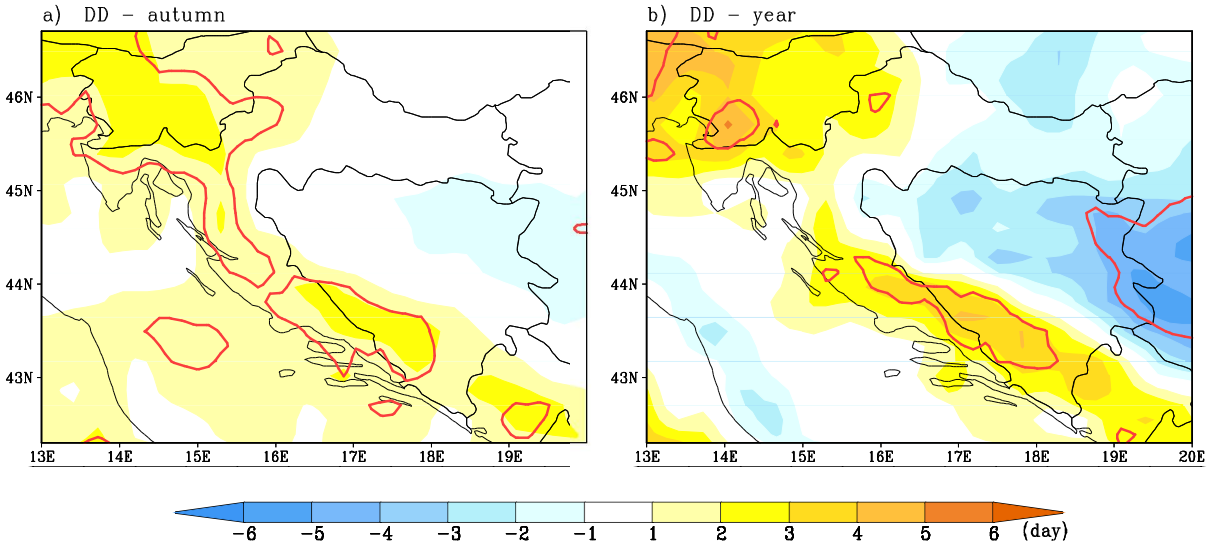

Figure 6.3.2-2. The near-future (2011-2040) change of the number of dry days (DD) with respect to the reference period (1961-1990) in: (a) autumn and (b) year. Statistically significant changes at the 95% confidence level are denoted by red contour.

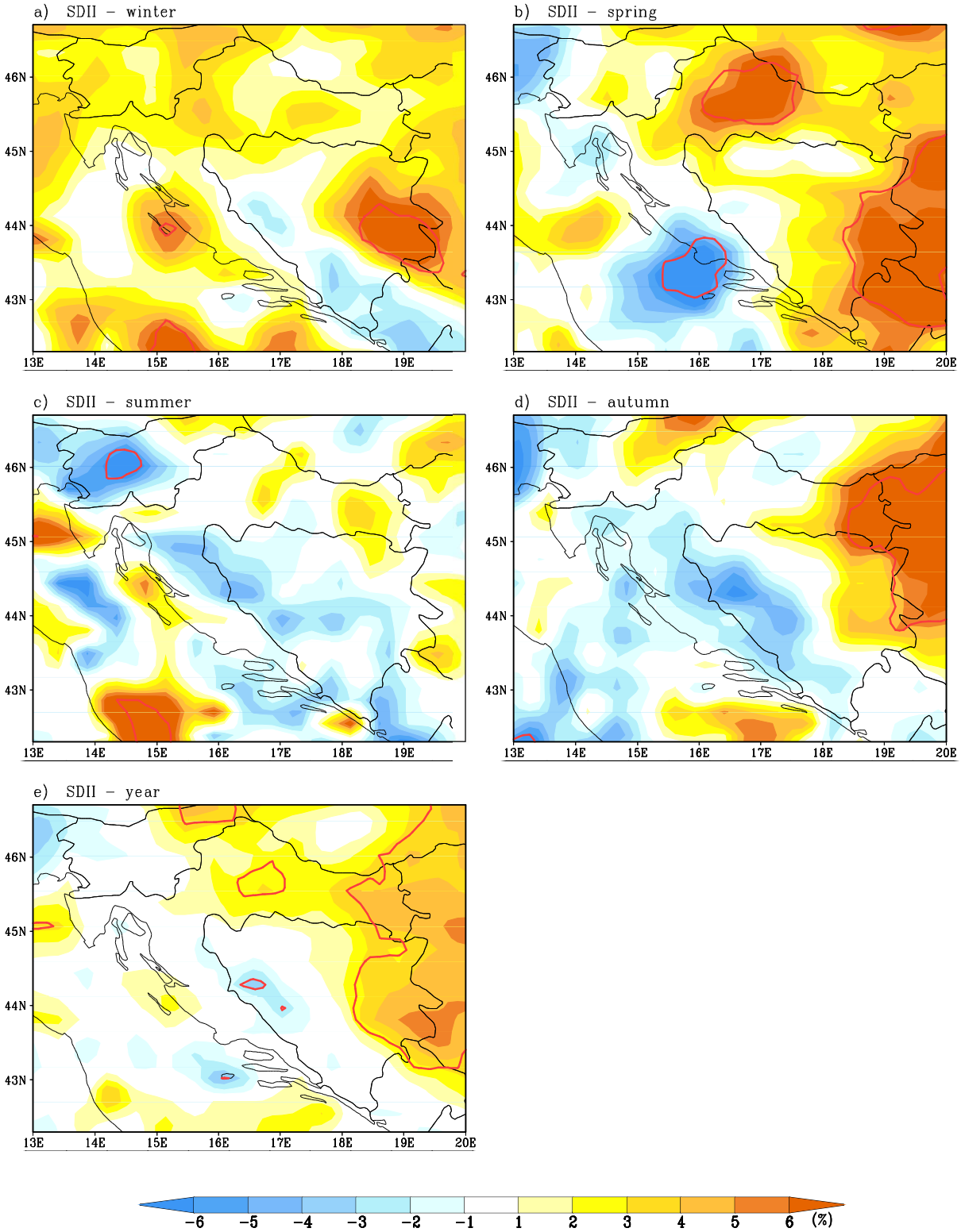

Figure 6.3.2-3. The near-future (2011-2040; P1) change in the simple daily intensity index (SDII) in (a-d) seasons and in (e) year relative to the reference period (1961-1990; P0). Changes are expressed as the percentages of SDII in the reference period. Statistically significant changes at the 95% confidence level are denoted by red contour

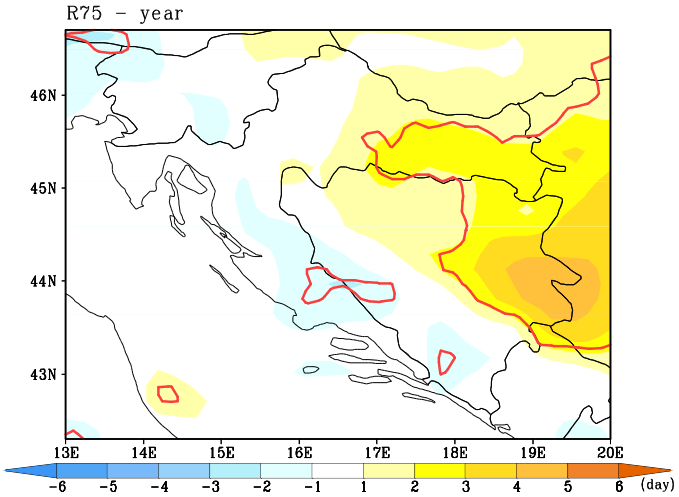

Figure 6.3.2-4. The near-future (2011-2040; P1) annual change of the moderate wet days (R75) with respect to the reference climate (1961-1990; P0). Changes are expressed as the differences in the index value between the future and the reference period. Statistically significant changes at the 95% confidence level are denoted by red contour

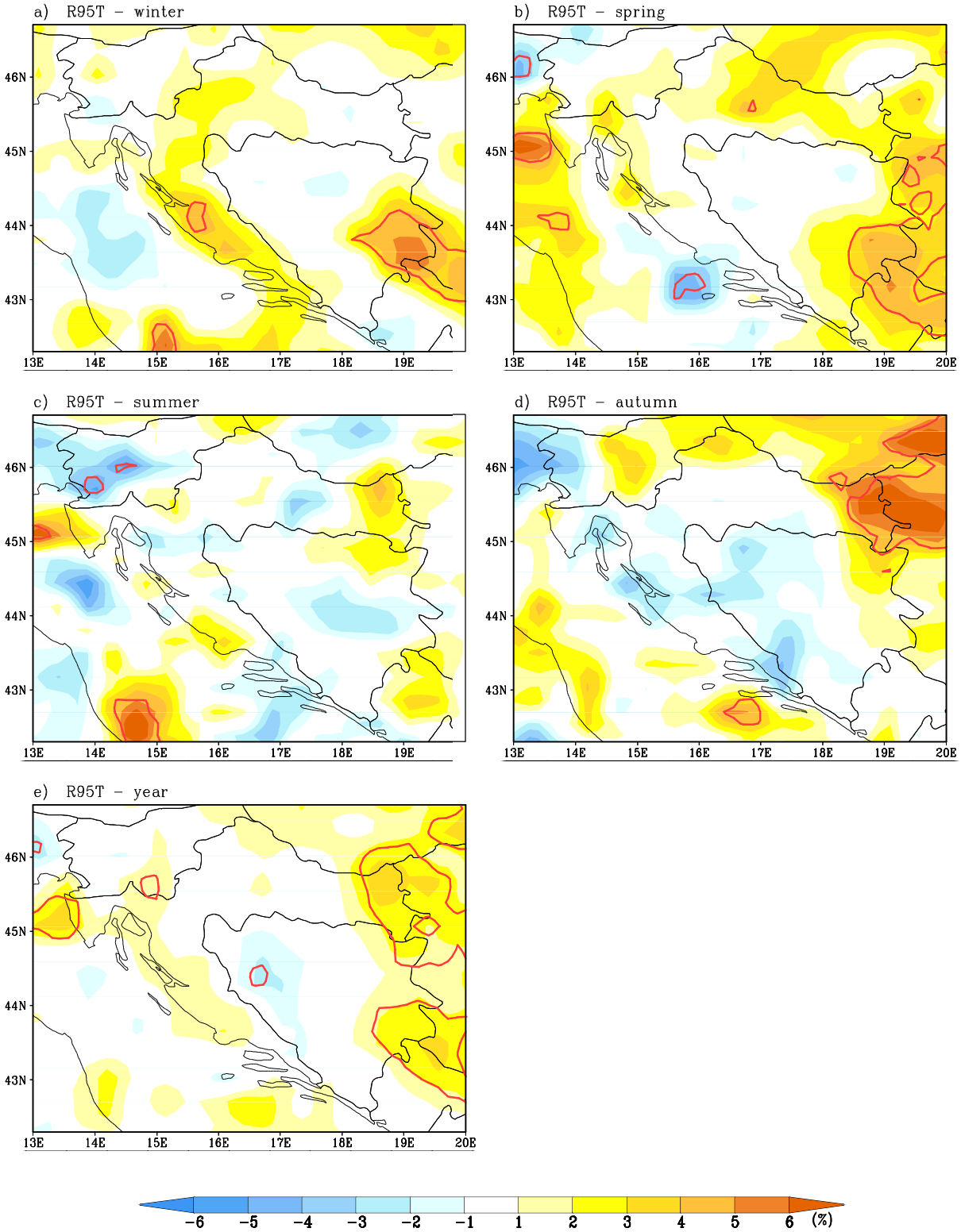

Figure 6.3.2-5. The near-future (2011-2040; P1) seasonal (a-d) and annual (e) change of the fraction of precipitation occurring on very wet days (R95T) relative to the reference period (1961-1990; P0). Changes are expressed as the differences in the index value between the future and the reference period. Statistically significant changes at the 95% confidence level are denoted by red contour

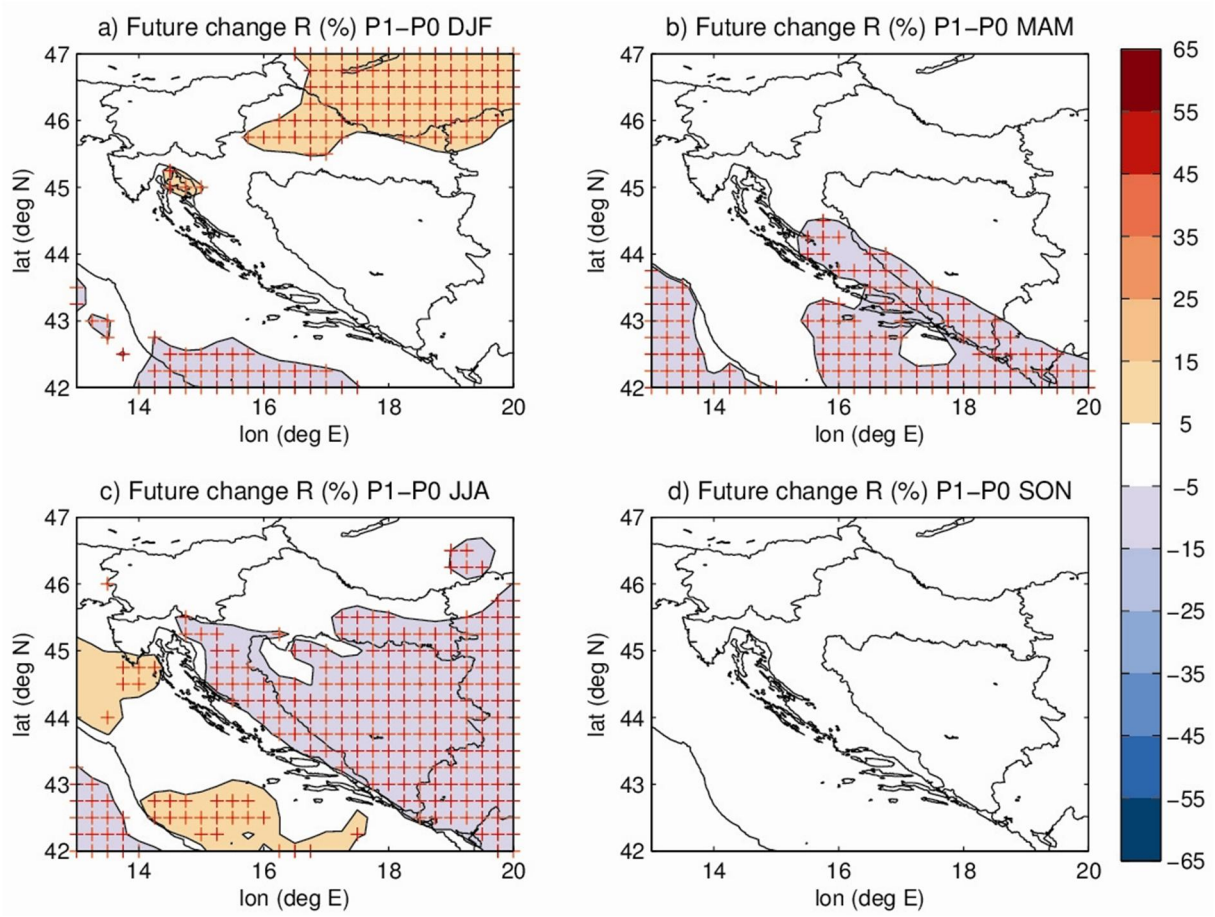

Figure 6.3.2-6. Ensemble-mean relative difference (in %) of the total precipitation between the periods P1 and P0 in: a) winter (DJF), b) spring (MAM), c) summer (JJA) and d) autumn (SON). The + sign denotes grid points where the sign of change in at least the two thirds of the models agrees with the sign of change of the ensemble mean difference and when the relative difference of ensemble means is outside the interval ±5%.

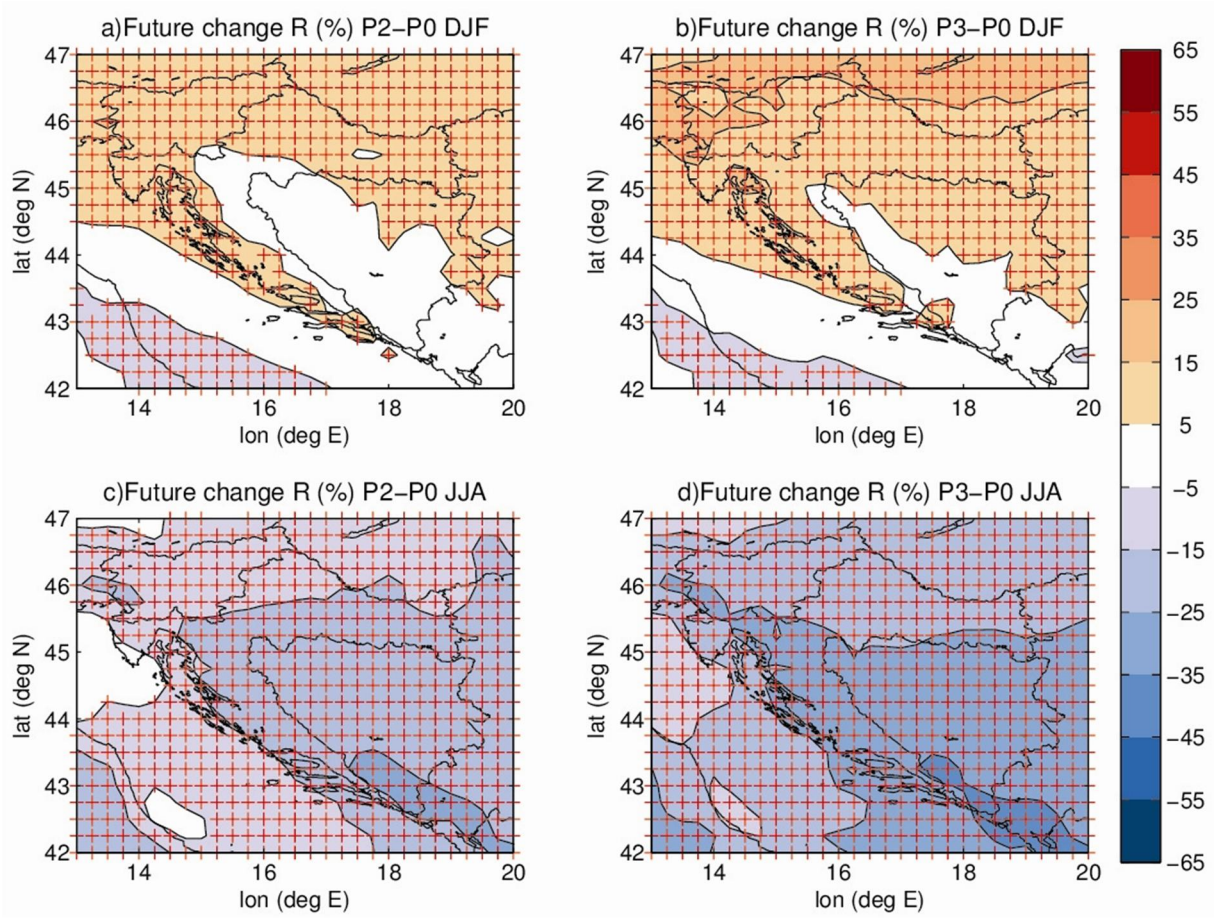

Figure 6.3.2-7. Ensemble-mean relative difference (in %) of the total precipitation in winter (DJF) for a) P2-P0 i b) P3-P0 and summer (JJA) for c) P2-P0 i d) P3-P0. The + sign denotes grid points where the sign of change in at least the two thirds of the models agrees with the sign of change of the ensemble mean difference and when the relative difference of ensemble means is outside the interval ±5%

6.3.4. Discussion and conclusion

An analysis of the climate change projections from the ENSEMBLES RCMs indicates a pronounced temperature rise in Croatia towards the end of the 21st century. For the IPCC A1B emission scenario, such a temperature increase is intrinsic to all RCMs irrespective of their physical formulations and differences among the models.

A comparison of climate change projections for Croatia in the near-future period 2011-2040 (P1) from the DHMZ RegCM simulations and from those of the ENSEMBLES project reveals that the largest warming of T2m in both sets of experiments could be expected in the summer season along the Croatian Adriatic coast and in its hinterland (Fig. 7.3.1-1c and Fig. 7.3.1-4c). The details of such a projected warming, however, differ: according to the DHMZ RegCM results, the strongest warming of about 1ºC is expected in the northern Adriatic region, whereas the ENSEMBLES models indicate the warming of 1.5-2ºC in the central and southern Adriatic. This may seem surprising since the emission scenario used in the DHMZ RegCM simulations was the A2 scenario which inherently includes a stronger forcing of the GHGs than in the A1B scenario which was used by the ENSEMBLES models. In the near future (P1), however, the forcing of GHGs does not differ significantly among various scenarios; the differences in forcing between A2 and A1B scenarios are becoming more pronounced only in the second half of the 21st century (Meehl et al. 2007). From our results for different scenarios and different models, it is important

to identify the agreement (or consistency) in the season (summer) and in the region (the Adriatic and the hinterland) that points out to the most probable projected warming of the near-surface temperature.

On the other hand, in the seasonal and monthly averaged total precipitation, a much larger diversity of the projected changes are found, depending on the region of Croatia or/and season. Thus, for example, in the period P1, the summer decrease in precipitation in the Adriatic hinterland is spatially more extended and more intense in the ENSEMBLES than in the DHMZ RegCM integrations (Fig. 7.3.2-1c and Fig. 7.3.2-6c). Towards the end of this century a larger parts of Croatia may be exposed to a more distinct changes in precipitation amounts. A clear emerging signal of climate change, relative to the present climate, is a moderate to high possibility of the precipitation increase in the winter and a reduction of the total precipitation in the summer

6.4. Impact and adaptation to climate change by areas

6.4.1. Hydrology and water resources

Waters are among major natural resources of the Republic of Croatia. Although it belongs to a group of countries for which water issues are not a limiting factor of development, climate changes will cause problems in water supply and meeting the evergrowing drinking water requirements.

Climate changes or variations combined with anthropogenic activities have significantly affected the changes in hydrological regime of open watercourses. Catchment areas of different sizes, geological and pedological base with different vegetation cover will respond differently to climate changes.

Research show that water resources in Croatia are already under challenge of climate change, as certain impacts and changes occur in regard to water flow, evapotranspiration, groundwater inflow, water level in rivers and lakes, water temperature, etc.

Change in precipitation form will influence not only the discharge, but the intensity, time period and frequency of floods and droughts as well. Some sources estimate that discharges in the largest watercourses of the Republic of Croatia will be decreased by 10% to 20%, although in eastern part of the country such change could be less than 10%. This issue requires research, since results of global and regional models of climate change indicate changes in precipitation in Croatia. Moreover, evapotranspiration increase due to temperature rise could also make an impact. Climate changes will, to some extent, impact electricity production in hydro power plants.

The Government of the Republic of Croatia adopted the River Basin Management Plan (OG No. 82/2013) and Croatian Waters prepare the Flood Risk Management Plan. In their measure programmes, documents contain adaptation measures to climate change consequences. For the purpose of water management, Croatian Waters carry out detailed water monitoring (water quantity and quality), research and develop water infrastructure.

6.4.2. Forestry

The assumed climate changes may lead to changes in spatial distribution of forest vegetation reflected in the altered share of current forest types, possible disappearance of the existing or appearance of new types, change in the density of population of certain tree species, productivity of forest ecosystems, ecological stability, forest health condition and the change in the overall productive and welfare forest value.

Croatian Adriatic coast, particularly islands, is a typical example of area where the common interconnection between water (precipitation) and fire is fully expressed. Generally, it can be said that, in summer, a number of fires and burned areas increase from the north to the south, as well as from the inland to the coast and islands, while in winter and early spring it is vice versa. Even the precipitation amount is decreased from north to south and from inland to islands. Due to its specificity, the most endangered areas considering forest fires are the islands, among them particularly middle Dalmatian islands. Results of global and regional models indicate that the largest changes could be expected in the coastal southern part of Adriatic.

The Dalmatian coast and islands in the summer months run a higher risk of wildfire than any other area in Croatia. This is due to the highly flammable plant cover and extended periods of drought. The human factor, i.e. an increase in tourists in the summer months, also adds to the potential danger. The Canadian *Fire Weather Index* is used to determine the potential danger of wildfire. One of the indices used is the *Monthly Severity Rating* (MSR), which in turn allows the *Seasonal Severity Rating* (SSR) to be estimated. The SSR refers to the estimation of potential wildfire risk during the fire season, from June to September, while the MSR refers to a particular month. Weather conditions conducive to the eruption of large fires prevail if the SSR ≥ 7.

An analysis of the MSR and SSR indicates that over the last 30 years the area which is at high risk of wildfire has spread from the Dalmatian coast and islands to include the interior (Table 6.4.2–1). The five stations which were observed represent different climate zones. Out of these, the Hvar station had the highest mean SSR, which rose from 6.9 in the period 1961–1990 to 7.5 in the period 1981–2010. An increased danger of wildfire has been noted in the northern Adriatic, as well as in eastern Slavonia in comparison with the period 1961–1990. August poses the greatest potential risk, followed by July.

An analysis of the linear trends of the MSR and SSR is in accordance with the previous comparison of the two observed periods. Based on data from the last 110 years (Table 6.4.2–2 and Figure 6.4.2–1), the analysis confirms that the area which is at higher potential wildfire risk is spreading from the mid-Adriatic to the northern Adriatic. To determine the extent to which results from the five stations are representative of particular areas, linear trends of the MSR and SSR were analysed for a further seven stations where meteorological data was available for the shorter period 1951–2010. The Lastovo and Knin stations in Dalmatia recorded the highest values in linear trends of the MSR and SSR, which are generally statistically significant. Out of the observed stations Lastovo has had the biggest increase in SSR (2.0/decade), while in Knin this amounted to 1.0/decade. The Lastovo station also recorded the highest MSR trends (3.0/decade in July and 2.3/decade in August). These high values confirm the conclusion reached in the analysis of the Hvar station. Over the last 60 years, Dalmatia has recorded a steep increase in wildfire risk, as well as an extended fire season. However, the last 60 years have also seen a statistically significant trend in the Croatian interior (Lika and eastern Slavonia). This means that wildfire is no longer an issue only relevant to the Adriatic coast and islands, but to other parts of

Croatia as well. The impact of climate change on wildfire risk is reflected in the tendency of the fire season to start earlier (in May), as well as the possibility for the fire season to extend until October, particularly along the Adriatic.

It should be emphasised that the results for Croatia are very much in line with those obtained in other countries. Thus the fire regime in Croatia fits into the bigger picture, which indicates that areas running a higher potential wildfire risk in the Mediterranean and eastern Europe in the summer months are expanding in size.

Table 6.4.2–1 Mean (MEAN), maximum (MAX) and minimum (MIN) monthly (MSR) and seasonal (SSR) severity ratings with standard deviation (STD) for Osijek, Zagreb-Grič, Gospić, Crikvenica and Hvar in the periods 1961–1990 and 1981–2010

Months	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**SSR**
	MSR						**Jun-Sep**
Osijek							
MEAN1961-90	2.14	2.11	3.61	4.14	3.20	2.18	3.26
STD	1.56	1.56	2.40	2.91	2.48	1.79	1.66
MAX	6.52	8.25	9.14	11.63	9.61	7.61	6.70
MIN	0.06	0.29	0.40	0.44	0.33	0.00	0.75
MEAN1981-10	3.22	3.22	5.59	5.96	3.60	2.29	4.59
STD	2.13	2.59	2.73	3.69	2.70	2.12	1.99
MAX	8.37	12.52	11.93	15.52	11.43	9.11	10.34
MIN	0.94	0.65	1.33	0.26	0.54	0.25	1.17
Zagreb-Grič							
MEAN1961-90	1.98	1.70	2.72	2.41	1.28	0.73	2.03
STD	1.61	1.14	1.87	1.98	1.18	0.71	0.78
MAX	5.82	5.49	6.77	8.72	5.69	3.30	3.86
MIN	0.14	0.43	0.77	0.60	0.23	0.01	0.83
MEAN1981-10	2.42	2.09	3.12	3.64	1.39	0.56	2.56
STD	1.74	1.33	1.79	3.30	1.24	0.64	1.31
MAX	8.19	5.52	7.31	13.89	5.51	3.30	6.30
MIN	0.50	0.43	0.81	0.39	0.05	0.06	0.83
Gospić							
MEAN1961-90	1.39	1.89	4.65	5.22	2.36	1.08	3.53
STD	1.24	1.71	2.87	4.12	2.98	1.87	2.14
MAX	5.75	9.49	11.31	15.87	12.64	10.33	8.96
MIN	0.14	0.44	1.27	0.42	0.15	0.00	0.97
MEAN1981-10	1.94	2.90	5.93	7.79	2.31	0.91	4.73
STD	1.73	2.20	3.21	6.25	2.34	1.86	2.70
MAX	9.04	10.04	13.34	27.75	10.90	10.33	13.88
MIN	0.14	0.38	1.27	0.90	0.12	0.00	0.97
Crikvenica							

MEAN1961-90	0.94	1.43	3.31	3.45	1.51	1.20	2.42
STD	0.76	1.25	2.20	2.68	1.55	1.25	1.39
MAX	3.55	4.79	8.32	14.37	6.31	4.63	7.41
MIN	0.04	0.12	0.91	0.30	0.07	0.00	0.39
MEAN1981-10	1.50	2.20	4.41	4.58	1.36	0.81	3.14
STD	1.53	1.79	3.14	2.99	1.17	1.05	1.57
MAX	6.22	6.46	13.22	10.74	3.85	4.18	7.51
MIN	0.04	0.23	0.91	0.30	0.07	0.01	0.39
Hvar							
MEAN	3.07	4.79	8.60	8.82	5.29	3.34	6.87
STD	1.76	2.61	2.89	3.63	3.71	2.58	2.46
MAX	7.10	11.30	13.53	17.64	15.22	10.41	12.01
MIN	0.59	0.80	2.79	2.93	0.76	0.12	2.60
MEAN	3.08	5.17	9.44	9.31	5.94	2.88	7.46
STD	1.40	2.71	3.02	3.82	3.69	2.53	2.29
MAX	7.10	11.30	15.95	17.64	15.22	10.41	12.01
MIN	0.87	1.78	3.94	1.76	0.36	0.45	3.28

Table 6.4.2–2 Linear trends of monthly (MSR) and seasonal (SSR) severity ratings at selected stations in Croatia mostly in the periods 1901–2010 and 1961–2010. Significant linear trends at the level ≤ 0.05 are marked in bold.

Months	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**SSR**
1901-2010	**MSR**						**Jun-Sep**
Osijek	-0.03	-0.18	-0.29	-0.24	-0.18	**0.06**	-0.22
Zagreb-Grič	**0.12**	-0.01	0.04	0.09	-0.03	-0.01	0.02
Gospić	-0.01	-0.14	-0.13	0.07	-0.08	0.03	-0.07
Crikvenica	**0.14**	**0.18**	**0.38**	**0.34**	0.06	**0.07**	**0.24**
Hvar	**0.10**	0.14	**0.42**	0.28	0.09	**0.14**	**0.23**
1951-2010							
Osijek	**0.03**	**0.20**	**0.47**	0.16	-0.12	0.00	**0.18**
Zagreb-Grič	0.17	0.10	0.11	0.17	-0.12	-0.05	0.06
Gospić	0.17	0.18	**0.46**	0.64	-0.18	-0.02	**0.28**
Rovinj	**0.32**	**0.55**	**1.02**	**0.87**	**0.46**	0.15	**0.67**
Rijeka	0.19	**0.30**	**0.66**	**0.67**	-0.17	-0.18	**0.36**
Crikvenica	0.08	0.25	0.41	0.24	-0.55	-0.21	0.09
Šibenik	-0.03	0.26	**1.06**	0.56	-0.25	-0.36	0.41
Knin	0.35	**0.72**	**1.73**	**1.44**	0.09	-0.08	**0.99**
Split-Marjan	-0.45	-0.15	**0.04**	0.99	0.19	-0.13	-0.33
Hvar	0.00	0.24	0.72	**0.21**	0.20	-0.02	**0.41**
Lastovo	**0.74**	**1.43**	**2.95**	**2.29**	**1.42**	0.44	**2.02**

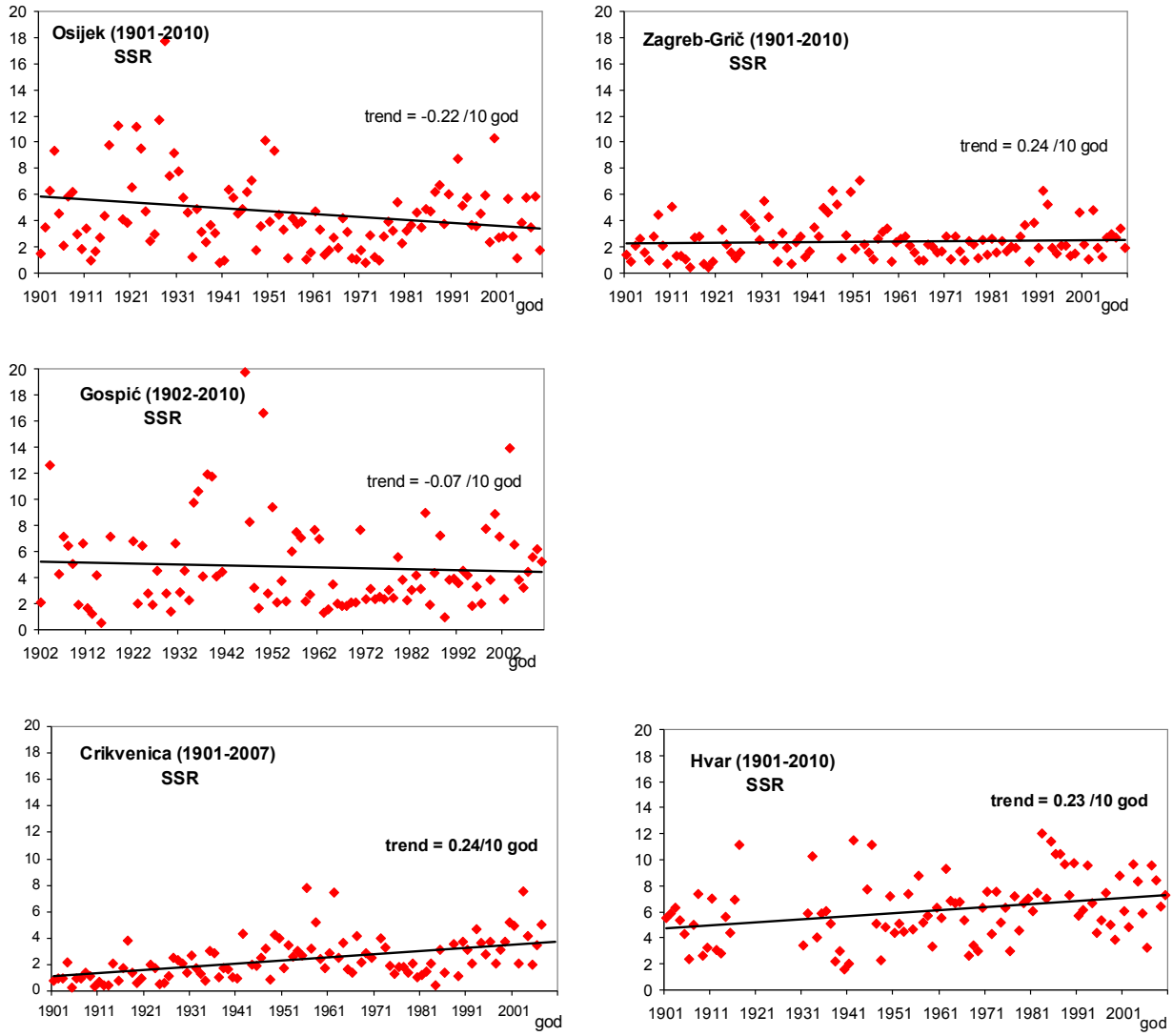

Figure 6.4.2–1. Time series of seasonal severity rate (SSR) and linear trends for the following meteorological stations: Osijek, Zagreb-Grič, Gospić, Crikvenica and Hvar in the period 1901–2010

6.4.3. Agriculture

Agriculture is closely related to the climate. General model of agriculture development through a long time period presumes munutal impact of climate, ecological and economic factors. The main issue in understanding the impact of climate change on the Republic of Croatia agriculture is that it is not possible to foresee precisely where and when will adverse or positive impact occur.

By the insight into possible climate change scenarios, as they are predicted by the experts of meteorological profession, it is evident that expected climate change is of such intensity and direction that it will gradually bring to significant changes in plant production systems and in certain measure in livestock breeding. The main feature of the environmental condition change is in the increase of CO_2 concentration in the atmosphere, increase of average annual temperature and probability of droughts in summer followed by water shortage of 30-60% in relation to the

present situation, as well as in occurrence of extremes regarding quantity, schedule and intensity of precipitation, air and soil temperature, wind power, hails, etc.

According to climate change scenarios, annual number of days of active vegetation (with temperature above 5°C) by the end of 21st century would be increased in the lowland parts of Croatia for 35 - 84 days, while a period with temperature above 20°C for 45 - 73 days. Areas for cultivation of individual cultures will be moved depending on culture needs for heat, light and water, thus usual perception of individual areas in the Republic of Croatia will surely be changed. It will result in changing the crop rotation in farming areas, suitable areals for orchards, vineyards and olivegroves will be moved, areas unsuitable for agriculture may become attractive and some of usual areas will become unsuitable or less suitable for usual plant cultivation system.

If such predictions come true, present technology of agriculture plant production will suffer great changes. However, by means of modern technology and in conditions of increased temperatures and providing enough amounts of water, total predicted climate change could bring to a positive effect on the increase in yields, especially winter crops which will be cultivated under mild winter conditions. In case of spring crops, changes in sowing schedule are possible, which will be earlier, whereby drought risk could be partially minimized, although water ensuring for irrigation would be more and more significant. Under irrigation conditions, increase in yields and sometimes better quality of cultivated agricultural crops may be expected.

Of course, predicted climate change can have negative effects as well, of which only some are predictable, and as regarding average amounts of damages, drought risk is at the first place, followed by hails, flood, frost, etc. Beside combination effects of various climate factors on a result in production of some crops (winter wheat, maize), other edaphic, economic and social factors influenced as well. Such combinations will be crucial for agriculture development in the future as well, along with probable development of new techniques, including precision farming, robots, etc.

Modern technology in wheat and maize cultivation enabled that today, along with the utilization of equal or smaller agricultural land, the yields are significantly increased. If the yields analysis is performed, it is easy to determine a crucial impact of weather conditions during some years when yields were quite lower than the average. The most common case of yields decrease is conditioned by water shortage but all other meteorological factors, which in various combinations influenced the yields realization in the Republic of Croatia, are of great importance as well.

Climate conditions limit wheat production to spring or winter cultivars to suitable areals. Winter wheat cultivars are dominant in the Republic of Croatia, while spring cultivars are usually also grown in regions with long, harsh winters. Unfavorable weather conditions during vegetative season played a critical detrimental role in winter wheat crop yields, averaging to lower yields every fifth year during the last 50 years. Majority of of the adverse impact is caused by water shortages during critical phenophases, followed by other factors such as surface water stagnation, frost, inability to adhere to optimal agrotechnical terms, etc.

Maize crop yield in the Republic of Croatia is mostly limited due to water shortages during flowering and fertilization phases and kernel starch filling. Late frosts in spring also cause adverse impacts, as does a long list of many other unfavorable weather conditions during crop

growth, all of which cannot be practically listed here. In the last 15 years there were years with extremely low maize yields, usually due to droughts.

All natural disasters and climate variability resulted in economical damage. In a period from 2000 to 2007, the Croatian counties reported damage on crops caused by extreme weather conditions in amount of EUR 1.4 billion. Therefore, a damage caused by existing climate conditions and climate variability has already an important impact on agriculture in the Republic of Croatia. The cause may or may not be in climate change, but certainly indicates on current vulnerability. In a period from 1980 – 2002, natural disasters caused approximately EUR 5 billion of damage in the Republic of Croatia. About 73% of these damages has been caused by weather conditions. Damage caused by drought, frost and hail – extreme weather conditions causing damage mostly in agriculture – is estimated to EUR 3.5 billion for the period from 1980 – 2002, which corresponds with amount of EUR 152 million per year. Drought caused the largest damage (65%), followed by hail, frost, rain, floods and wind/storms.

Agriculture adaptation to scenarios of foreseen climate change is possible, but along with knowledge of all participants, from farmers, advisory service, administrative officers, scientists, teachers, as well as all others, a lot more financial funds should be invested.

6.4.4. Biodiversity and natural terrestrial ecosystem

The IPCC report "*Climate Change 2007, Impacts, Adaptation and Vulnerability*" from 2007 indicates that if monitoring for a long-term, ecosystem resistance, i.e. natural ability of adaptation will be disturbed due to combination of climate variability, extreme weather and natural features (floods, droughts, fires, parasites, etc.) and changes in land use, soil pollution and irrational exploitation of natural resources. It should point out that individual terrestrial ecosystems represent significant carbon storages and have key role in carbon cycle.

In the area of the Republic of Croatia, three various interconnected impacts of climate change on species are expected: phenological, distributional and genetic. Phenological changes, recorded in Europe, such as the shift in a period of the freshwater fish spawning and earlier arrival of migratory birds from the wintering grounds, occur in the Republic of Croatia as well.

Research of climate change impact on plants is based on the idea that plants are the first that react to weather and climate change, for which purpose the phenological data are suitable for monitoring development phases of certain plant species. Results of linear trends of longterm phenological phases of common lilac, apple and olive trees from phonological stations Daruvar, Zagreb, Gospić, Rab and Hvar, mostly from the period 1961-2008, are indicated below. The stations were chosen in order to cover basic climate types in Croatia: continental, mountainous and Mediterranean, as well as the city part of Zagreb.

Weather conditions of the last years less and less follow known annual and seasonal cycles and there are more and more extreme weather events not following average conditions. Thus, for example, during 2007, due to extremely warm winter and spring, phenophases occurred much earlier. Analyses of linear trends of olive tree phenophases along the Adriatic coast and islands, as well as forest trees and fruit trees phenophases in mountainous Croatia within the last 50 years, indicated significant earlier beginning of their flowering (2–4 days/10 years) as a result of significant increase of spring air temperature values in this area.

In the Croatian inland, vegetation period for the majority of plants begins in March or April. The beginning of common lilac leaf unfolding in Zagreb is on 26 March in average, while in Daruvar on 1 April (table 6.4.4-1). Naturally, the periods are changed from year to year, so the range between the latest and the earliest date can be even month and a half. The flowering usually starts three weeks after the leaf unfolding, while its fully flowering the common lilac achieves a week after the flowering start. High values of standard deviation (8-12 days) also indicate to a great annual variability of common lilac leaf unfolding and flowering from year to year

In mountainous Croatia the beginning of vegetation is moved to April and May, so in Gospić the common lilac is usually leaf unfolding on 15 April and flowering on 6 May. It is exactly a month later than in Hvar. Naturally, a limit of vegetation beginning is earlier as it moves to the south of Croatia. Comparison between northern and middle Adriatic shows 4-5 days earlier start of common lilac leaf unfolding and flowering in Hvar than in Rab.

In average, apple tree is leaf unfolding and flowering two weeks earlier in Daruvar (9 and 17 April) than in Gospić (25 April and 2 May). Apple maturation also starts two weeks earlier in Daruvar (6 September) than in Gospić (22 September). Such vegetation period of apple tree in the Croatian inland lasts for seven months, while in mountainous Croatia for six months due to an earlier beginning of colouring and leaves falling. Appearance of the first flowers, full flowering and end of olive tree flowering is a week earlier in Hvar than in Rab. However, first ripe fruits are usually by the middle of October, while the picking is in the first 10-day period in November at both locations.

In order to estimate a tendency of delay/earliness of phenophases in the Republic of Croatia, linear trends of their appearance have been calculated for observed long-time period (Table 6.4.4-3 and Figure 6.4.4-1). Linear trends values in table 6.4.4-3 are reduced to 10-year period. One of the methods providing the evaluation of statistical significance of limit change, around which the members of time series are distributed, i.e. evaluation of linear trend existence is nonparametric Mann-Kendall rank test (Michell et al., 1966).

Statistically significant trend at the level of 0.05 is noticed in earlier flowering of observed plants (2-4 days/10 years) in all climate zones, except in city of Zagreb. Air temperature rise in Zagreb cannot be just a result of global warming, but in rapid expansion of Zagreb in the last hundred years.

Earlier apple tree flowering (3-4 days/10 years) is more expressed in the mountainous Croatia than in the inland (2 days/10 years). Significant trend of apple tree ripe fruits and picking is noticed only in the inland of Croatia, as well as a tendency of vegetation extension (leaves falling is later 2 days/10 years). On the contrary, in the mountainous Croatia a negative trend of apple tree colouring and leaves falling (3 days/10 years) has been observed, which indicates to shortening the vegetation period in autumn.

Olive tree flowering is earlier 2 days/10 years in northern Adriatic, while in Dalmatia 3 days/10 years. Earlier olive ripening 2 days/10 years is observed in Dalmatia, while earlier picking is not just a result of weather conditions, but it depends on available olive oil processing plants, amount of yield that can be processed at defined moment, as well as on market demand for certain oil quality.

Analysis of climate change impacts on plants indicated in all climate zones an earlier beginning of flowering of observed plants in spring, which is a result of warmer winter and spring. In autumn there is no such unambiguous delay in colouring and leaves falling in all climate zones, i.e. vegetation period extension is observed in the inland, but not in the mountainous Croatia. These results are in accordance with observed more expressed mean air temperature rise in spring than in autumn.

Grapevine cultivation and wine production have had a long tradition in Croatia, which is why it is important to determine the impact of climate changes on cultivation and crop yield. In order to observe the changes in the beginning of development stages over the years, an analysis was made of phenological data for the well-known grapevine varieties *Riesling Italico*, *Malmsey* and *Plavac Mali* in the period 1961– 2010. Research worldwide indicates that future climate changes will not have an identical impact on all varieties and cultivation areas. Consequently, certain new areas will acquire optimum conditions for cultivating certain grapevine varieties. However, it is also expected that areas currently known for grapevine cultivation will expand their range of varieties, which will ultimately lead to wines losing their regional character.

The onset of the vegetation period in grapevines depends primarily on the temperature. Active temperature is achieved when the mean daily air temperature is above 10°C. On average, on the Adriatic coast sprouts begin to appear in the final week of March and this phase lasts until the end of the second ten-day period of April, while in the continental area this phase spans the second half of April (see Table 6.4.4–1). The final development stage is fruit picking, whose onset is not as uniform as that of the beginning of sprouting since it depends on whether grapes belong to an early or late variety. On average, fruit picking begins anywhere from the end of July until mid-October on the Adriatic coast, and from mid-August until mid-October in the continental region. A high standard deviation (12–18 days) was noted for some grapevine varieties at Dalmatian stations in the period 1981–2010. This was observed in the following phases: beginning of ripening, full ripening and fruit picking, which indicates a great variability in the onset of these pheno-phases from year to year. A comparison of the duration of the grapevine vegetation period (from beginning of sprouting to fruit picking) over the last three decades with the referent period 1961–1990 indicates that vegetation lasts shorter on average for all the observed varieties.

The duration of the ripening period in grapes is defined as the difference between the mean date of the onset of full ripening and the beginning of ripening. Over the last 30 years the ripening period has been reduced by as much as 2 weeks (Table 6.4.4–2). The shortening of the vegetation period is more due to the fruit picking phase beginning earlier in the summer than to the earlier onset of vegetation in the spring. This affects the sugar-acid ratio in grapes, as well as wine quality, and results in higher alcohol content, which in turn makes certain varieties harder to identify. Linear trends indicate an earlier onset of spring pheno-phases in *Riesling Italico* at stations in continental Croatia, as well as in *Malmsey* in Istria, by 2–3 days/10 years (Table 6.4.4–3 and Figure 6.4.4–1). In Dalmatia, *Plavac Mali* shows a significantly earlier beginning of sprouting, leaf unfolding and flowering only at the Hvar station. Trends are positive for the beginning of ripening of *Riesling Italico* in Križevci and Daruvar, as well as *Plavac Mali* in Hvar and Orebić by 2–6 days/decade. The onset of full ripening and fruit picking comes significantly earlier in continental Croatia and Istria than in the mid-Adriatic. This is confirmed by winegrowers whose experience indicates that there are greater changes in the earlier onset of pheno-phases in continental Croatia than in Dalmatia. For instance, the extremely hot years at the beginning of the 21st century saw earlier and later varieties experience ripening at practically

the same time. Consequently, the grapes had a very high sugar content, which resulted in wines with a high alcohol content. Such wines resemble Dalmatian wines, so cultivation of red grape varieties has become more frequent in continental Croatia.

Table 6.4.4–1. Mean (MEAN), the latest (MAX) and the earliest (MIN) dates of pheno-phases for grapevine with standard deviation (STD) for selected stations in Croatia mostly in the period 1961–2010. BS: Beginning of sprouting (2-3 cm); BR: Beginning of ripening; UL: Leaf unfolding (2x3 cm); FR: Full ripening; BF: Beginning of flowering/ First flowers open; RP: Fruits ripe for picking;EF: End of flowering

PHENO-PHASES			BS	UL	BF	EF	BR	FR	RP
RIESLING ITALICO	Daruvar	MEAN1961-90	25.4.	3.5.	12.6.	21.6.	22.8.	26.9.	5.10.
		STD	9	9	6	6	5	5	6
		MAX	9.5.	16.5.	26.6.	4.7.	1.9.	3.10.	15.10.
		MIN	4.4.	15.4.	2.6.	12.6.	11.8.	14.9.	16.9.
		MEAN1981-10	22.4.	30.4.	6.6.	17.6.	27.8.	17.9.	27.9.
		STD	8	9	9	8	9	14	11
		MAX	9.5.	14.5.	21.6.	29.6.	10.9.	3.10.	8.10.
		MIN	3.4.	9.4.	7.5.	22.5.	29.7.	7.8.	27.8.
	Križevci	MEAN1961-90	27.4.	4.5.	11.6.	19.6.	24.8.	2.10.	13.10.
		STD	8	9	6	6	8	7	7
		MAX	10.5.	20.5.	26.6.	3.7.	10.9.	22.10.	27.10.
		MIN	12.4.	16.4.	4.6.	12.6.	13.8.	23.9.	1.10.
		MEAN1981-10	22.4.	29.4.	6.6.	17.6.	28.8.	25.9.	3.10.
		STD	8	8	10	6	8	6	8
		MAX	4.5.	12.5.	22.6.	29.6.	16.9.	5.10.	17.10.
		MIN	5.4.	12.4.	11.5.	6.6.	16.8.	15.9.	20.9.
MALMSEY	Čepić	MEAN1961-90	26.4.	1.5.	9.6.	18.6.	19.8.	19.9.	25.9.
		STD	9	9	6	6	5	7	10
		MAX	6.4.	10.4.	28.5.	9.6.	11.8.	1.9.	15.9.
		MIN	28.3.	3.4.	15.5.	25.5.	5.8.	20.8.	5.9.
		MEAN1981-10	18.4.	26.4.	31.5.	12.6.	20.8.	12.9.	22.9.
		STD	10	10	8	7	9	12	6
		MAX	5.5.	12.5.	13.6.	25.6.	10.9.	27.9.	2.10.
		MIN	28.3.	3.4.	15.5.	25.5.	5.8.	20.8.	5.9.
PLAVAC MALI	Hvar	MEAN1961-90	12.4.	18.4.	31.5.	9.6.	15.8.	16.9.	30.9.
		STD	7	7	5	5	8	14	6
		MAX	29.3.	4.4.	23.5.	30.5.	3.8.	20.8.	20.9.
		MIN	22.4.	29.4.	13.6.	21.6.	31.8.	7.10.	13.10.
		MEAN1981-10	5.4.	11.4.	26.5.	5.6.	20.8.	14.9.	29.9.
		STD	11	10	8	5	6	15	8
		MAX	18.3.	25.3.	13.5.	28.5.	10.8.	25.8.	10.9.
		MIN	22.4.	26.4.	14.6.	15.6.	31.8.	7.10.	13.10.
	Orebić	MEAN1961-90	15.4.	21.4.	30.5.	7.6.	17.8.	24.9.	30.9.
		STD	10	10	8	7	9	10	10
		MAX	29.3.	4.4.	12.5.	20.5.	1.8.	26.8.	29.8.
		MIN	30.4.	5.5.	17.6.	24.6.	7.9.	8.10.	16.10.
		MEAN1981-10	16.4.	21.4.	28.5.	6.6.	29.8.	26.9.	1.10.
		STD	8	8	5	5	11	8	7
		MAX	4.4.	13.4.	14.5.	23.5.	23.7.	20.8.	20.9.
		MIN	27.3.	2.4.	20.5.	26.5.	13.8.	3.9.	13.9.
	Lastovo	MEAN1961-90	19.4.	25.4.	31.5.	9.6.	13.8.	23.9.	2.10.
		STD	7	7	8	7	12	12	7
		MAX	29.4.	4.5.	20.6.	25.6.	5.9.	16.10.	16.10.
		MIN	4.4.	13.4.	14.5.	23.5.	23.7.	20.8.	20.9.
		MEAN1981-10	19.4.	24.4.	30.5.	9.6.	13.8.	17.9.	30.9.
		STD	9	9	6	6	15	18	10
		MAX	4.5.	8.5.	11.6.	19.6.	5.9.	16.10.	16.10.
		MIN	28.3.	3.4.	17.5.	27.5.	17.7.	18.8.	9.9.

Table 6.4.4–2. Mean duration (days) for ripening of Riesling Italico and Plavac Mali from beginning to full ripening at the Daruvar and Hvar stations in the following periods: 1961–1990, 1971–2000 and 1981–2010

Variety	**Stations**	**Ripening duration of grape vine (days)**		
		1961.–1990.	1971.–2000.	1981.–2010.
Riesling Italico	Daruvar	35	30	22
Plavac mali	Hvar	32	33	26

Table 6.4.4–3. Linear trends of phenophases (day/decade) for grapevines at selected stations in Croatia mostly in the period 1961-2010. Significant linear trends at the level ≤ 0.05 are marked in bold

Trend (day/decade)	***Pheno-phases***	***BS***	***UL***	***BF***	***EF***	***BR***	***FR***	***RP***
RIESLING ITALICO	***Daruvar*** *1961-2010*	***-1.55***	*-1.49*	***-3.01***	***-1.88***	***2.34***	***-3.73***	***-3.10***
	Križevci *1961-2010*	***-2.22***	***-2.40***	*-2.36*	*-0.35*	***1.95***	***-4.43***	***-5.24***
MALMSEY	***Čepić*** *1968-2010*	***-3.23***	***-1.92***	***-5.03***	***-2.90***	*-0.49*	***-4.88***	*-2.29*
PLAVAC MALI	***Hvar*** *1962-2010*	***-3.87***	***-3.85***	***-2.35***	***-1.50***	***2.41***	*-0.20*	*-0.81*
	Orebić *1962-2010*	*0.19*	*-0.25*	*-0.27*	*-0.34*	***6.23***	*0.98*	*0.53*
	Lastovo *1961-2010*	*-0.30*	*-0.67*	*-0.20*	*0.15*	*-0.64*	*-3.70*	*-1.02*

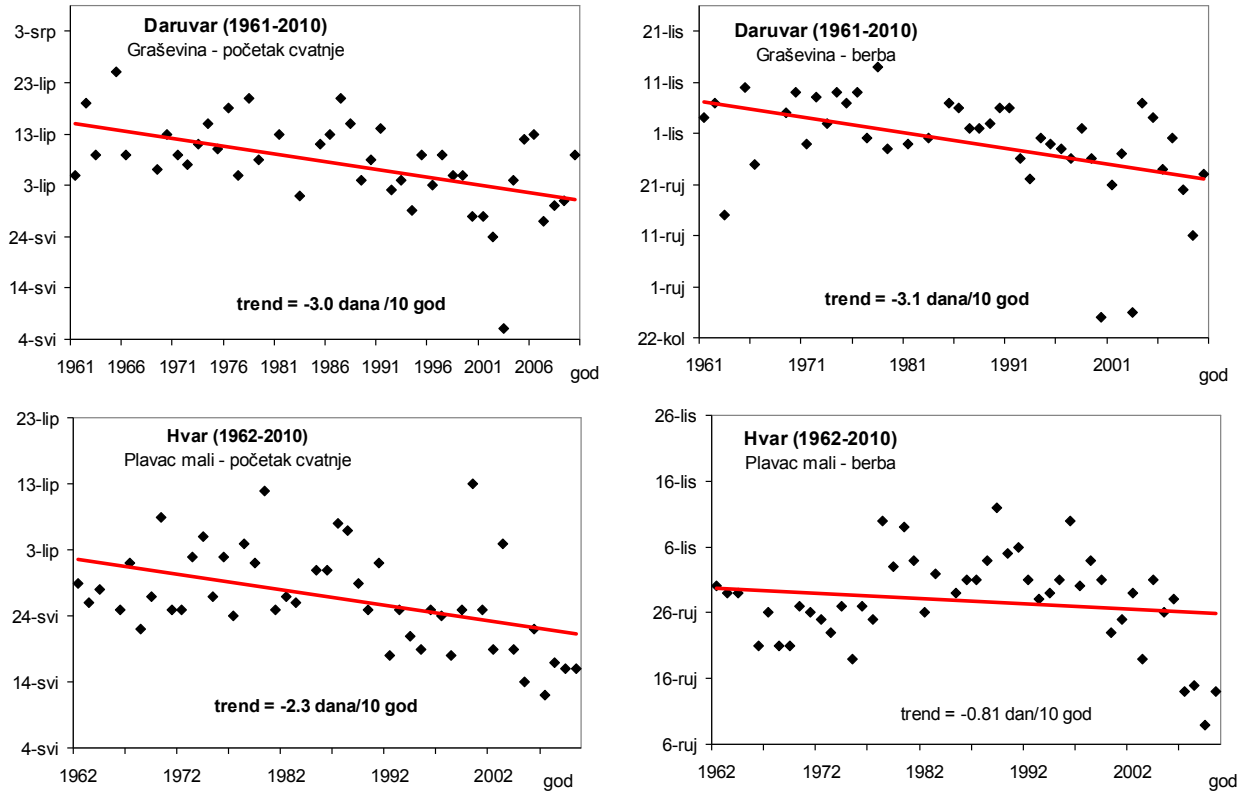

Figure 6.4.4–1. Time series of phenological phases of grapevines and linear trends for Daruvar and Hvar in the period 1961–2010

Considering the climate change impact on species distribution, applying the Hopkins' Bioclimate Law saying that a temperature rise of 3°C corresponds to the shift of vegetation by altitude of 500 m, it is predicted that the vegetation of the pre-mountain region of the Dinarides will be replaced by the vegetation of a temperate climate zone. The most endangered will be plant species of a circumpolar (40 species), pre-Alpine (266 species) and of the Alpine (607 species) distribution. Particularly endangered will be rich and endemic flora of small southern and middle Adriatic islands of small migration possibilities.

Populations of numerous species, especially those on the edges of the areals, are expected to be exposed to fragmentation to smaller subpopulations. The populations possessing large and numerous subpopulations and migrating slowly will lose the least genetic diversity and vice versa.

If the sea level increases, wetlands and ponds, as worth habitats of great biodiversity, could be facing a great challenge. In such way, for example, a sea water flood could harm a vulnerable balance of Vrana Lake Nature park – the only large wetland near the Adriatic coast representing a special ornithological reservation of great biodiversity.

Main indirect measures for the protection of terrestrial ecosystems and biodiversity are:

- ex-situ and in-situ protection of threatened species, especially endemics, in order to protect the gene fund,

- preservation of migratory corridors for species able to survive by changing the area and scope of appearance,
- adjustment of physical plans and protected areas management plans,
- planning/predicting changes in boundaries of protected areas,
- adjustment of protection programmes at the species level,
- development of infrastructure for scientific evaluation of the status, forecast and monitoring of changes in terrestrial ecosystems and biodiversity.

6.4.5. Coast and coastal zone

Coast and coastal zone is strategically important natural, economic and cultural resource of the Republic of Croatia and Mediterranean as a whole. Within the context of climate change impact on coast and coastal zone, the largest risk is increase of sea level, which may cause a number of irreversible and adverse effects indicated in addition.

There are two main reasons of sea-level increase: increase of sea water volume due to surface warming and melting of ice cover and Alps glaciers, which contributes to increase of sea water volume. It should point out that sea-level increase could be caused by short-term extreme weather events (storms, floods and erosions) as well.

The IPCC report "Climate Change 2007, Impacts, Adaptation and Vulnerability" from 2007 indicates, based on scientific research, six conclusions related to climate change impact on coast and coastal zone relevant for the Republic of Croatia as well:

- coast and coastal zone are extremely vulnerable to extreme weather events related to climate change;
- coast and coastal zone will be exposed to increased risk of adverse effects due to climate change in the next middle-term period;
- climate change impact on coast and coastal zone is increased due to larger adverse anthropogenic effects, out of which not planned and often illegal construction in coastal zone should be pointed out;
- coast and coastal zone adaptation to climate change will be more demanding in developing countries due to limitation in adaptation capacities;
- costs of coast and coastal zone adaptation to climate change are much lower than the costs of damages occurred due to a lack of adaptation measures;
- short-term planning related to the exploitation of coast and coastal zone resources is not complied with expected sea-level rise.

Although the Croatian coast is relatively steep, dimensions of sea-level rise effects in coastal zone might be significant. The centres of hystorical coastal cities represent the most valuable cultural heritage of the Republic of Croatia and they are among the main tourist attractions. The rough analysis indicates that numerous city centres will be in trouble caused by sea-level rise, particularly by stormy weather. Besides, the Croatian coast is exposed to strong urbanization. It is estimated that in the last fifty years, there was four times more coastal area built than in all previous generations together. Although this trend is slowed down lately, it is expected to go on in the future.

Based on available research published in the Human Development Report – Croatia 2008 "A Climate for Change" (UNDP, 2008), dealing with climate change impact on sea-level rise in the

Republic of Croatia, the following areas potentially vulnerable to the sea-level rise have been identified:

- cities: Nin, Zadar, Šibenik, Split, Stari Grad (island of Hvar), Dubrovnik,
- rivers: Raša, Cetina, Krka, Zrmanja, Neretva,
- lakes: Vrana lake (island of Cres), Vrana Lake Nature Park near Biograd,
- island of Krapanj,
- west Istrian coast.

The sea-level rise may affect a number of commercial fishing ports and fixed marinas, may pollute coastal or sub-coastal freshwater springs in karstic area, may affect touristic and recreative activities depending on coastal zones, etc.

The coast and coastal zone planning and management, aiming at their preservation and sustainable development, as well as climate change adaptation, requires an integral approach taking into account national particularities and diversities, especially specific needs of islands related to their geomorphological features. The Republic of Croatia ratified the Protocol on Integrated Coastal Zone Management in the Mediterranean (OG – International Treaties, No. 8/2012) and undertook preparation of national strategy for integrated coastal zone management and coastal implementation plans and programmes pursuant to the common regional framework and according to the objectives and principles of integrated management from this Protocol.

For the purpose of minimizing the coast and coastal zone vulnerability to the sea-level rise and taking into consideration the uncertainties of sea-level rise assessment, the following planning and technical adaptation measures were identified:

- improvement of institutional and organizational capacities for integrated coas and coastal zone planning and management,
- preparation of national strategy for integrated coastal zone management and coastal implementation plans and programmes with measures and costs,
- more detailed mapping of coastal zone, spatial features, land use samples and economic activities,
- cooperation with scientific-research institutions developing global and regional databases and prognostic models related to the forecast of sea-level rise and analyses of adaptation measure effects and their costs,
- technical measures include, but not limited to: beach replenishment, construction of groynes and sea-walls, raising structures above flood elevations, development of alternative water supply resources, planning and construction of new water treatment capacities due to increase of salinity.

The project "Integration of Climatic Variability and Change into Coastal Plans and National ICZM Strategies", financed by the General Environment Facility (GEF), is an example of activity regarding the construction of capacity for coastal zone adaptation to climate change. The project implemented by PAP/RAC[24] from Split, in cooperation with Plan Bleu from France, carries out the following activities in the Croatian coastal zone:

[24] PAP/RAC and Plan Bleu are part of the Mediterranean Action Plan (MAP) – United Nations Environment Programme (UNEP). More information at http://www.pap-thecoastcentre.org

- Assessment of potential costs caused by climate change and variability by method - DIVA (Dynamic Integrated Vulnerability Assessment) for Croatian coast and conversion of these costs along with usage of local data for Šibenik-Knin County;
- Preparation of Integrated Coastal Zone Management Plan (ICZM) with special emphasis on climate variability and change;
- Participatory method "Climagine", structured inclusion of participants from Šibenik-Knin County and defining of ICZM Plan (as described in chapter 9.).

The purpose of all these activities is indicated in very title of the project, aiming at assessing dimensions of potential climate change consequences, raising the awareness on dimensions of these effects and including recommendations for implementing into strategic documents related to the coast sustainable development.

Within this project, the ICZM Plan for Šibenik-Knin County will be prepared as demo project for all Mediterranean countries, signatories of the aforementioned Protocol and preparation of unique national strategy for integrated coast and sea management was proposed as well.

The Šibenik-Knin County ICZM Plan is in initial phase, where main threats have been analysed and decided which topics should be analysed in more details, i.e. in which spheres of life and economic activities of the County the climate change could be the largest threat. Identified topics are surely the low coasts in County, which could be physically endangered by sea-level rise, i.e. by stormy weather and coastal buildings. The largest changes in County are expected in water management sector, whether concerning drinking water, surface or ground water. It will affect many spheres of life in the County, including nature as well, even travertine downstream beds on the river of Krka. The change in precipitation regime will bring us more water when we do not need it, i.e. in winter, and less water when we need it, i.e. in summer. Increase of summer heat periods, along with droughts, will minimize the attraction of our coast for living and tourism, endanger agriculture and additionally increase the fire risk. The structured participation of actors through Climagine method is of special importance, where local knowledge and opinions are implemented into the common Plan. Through Climagine method, the local participants assessed that fire risk is the closest climate threat for the Šibenik-Knin County. How to prepare for these new coming conditions, among other things, are topics for ICZM Plan proposal that should be finished in 2014.

6.4.6. Marine ecosystems and fish resources

The Republic of Croatia has a long history of fishing and mariculture and a coastline that is well suited for developing a modern industry in these areas. The climate change impact on marine ecosystems and biodiversity has both positive and adverse effects. The Human Development Report – Croatia 2008 "A Climate for Change" (UNDP, 2008) indicates research results showing that the abundance of marine fish populations is already showing significant fluctuation, i.e. these populations are changing behaviour and migration patterns in the Adriatic, which has implications for fish catches. Climate change, i.e. sea water warming is of a great significance for these fluctuations.

Research has shown a large movement northward of fish species that are more suited to warmer water. Many new species in the northern parts of the Adriatic Sea have been recorded over the last thirty years. The effects of these occurrences could be of two kinds, depending on whether considered from the economic or ecological point of view. For example, groupers migration

from south to the middle and north Adriatic had positive economic effect on fishery, as grouper is a rare and wanted fish. However, due to competition, an adverse effect occurred for some domestic species.

Positive effect of climate change is possible in mariculture field. Species, which are better adapted to the higher sea temperatures, for example, sea bream, due to increase of sea temperature in winter, it could have more favourable conditions for growing. The increase of sea temperature would probably favour to tuna breeding, as the most important economic product in fishing and mariculture sector.

Table 6.4.6-1 indicates likely impact of sea temperature increase due to climate change on individual commercial fish in the Republic of Croatia.

Table 6.4.6-1: Likely impact of sea temperature increase due to climate change on individual commercial fish in the Republic of Croatia

Type of fish	**Mariculture and/or fishing**	**Likely impact of climate change**
Tuna	mariculture	positive due to increased temperatures
Flat Oyster	mariculture	negative – especially if temperature is over 26.5 °C
Sea Bass	mariculture	negative due to increased temperatures
Sea Bream	mariculture/fishing	positive- faster growth, prolonged spawning season
Sardine	fishing	moving of spawning centres, expanding of spawning period, negative according to effects of predators
Anchovy	fishing	moving of spawning centres, expanding of spawning period, negative according to effects of predators
Hake	fishing	moving of spawning centres, expanding of spawning period
Norwegian lobster	fishing	effects on boreal species, changes in bathymetric distribution

Source: Human Development Report – Croatia 2008 "A Climate for Change", UNDP 2008.

Climate change and sea temperature increase may have the following impacts on the fishing sector in the Republic of Croatia:

- temperature increases will heighten the risk of oxygen level decrease and depletion in shallow areas of the Adriatic. This situation will create conditions that allow for the increase of species that tolerate warm water and lower oxygen levels;
- due to faster biological processes at all levels of marine ecosystems, the growth rate of fish should be higher and reproduction seasons should be longer for most species. As a result, the recruitment of species that thrive in warm water should be significantly better;
- the opposite is likely to occur with species that thrive in cold water, such as Norwegian lobster. These species will migrate to colder areas, either horizontally (moving north, south, east or west) or vertically (moving to deeper levels);
- introduction of new disease organisms or exotic or undesired species is likely to occur due to increased sea temperatures.

In order to react to climate change impacts on time and as appropriate, establishment of adaptable sector managing should be promoted. In order to identify, understand and predict all interactions between climate and marine ecosystem, research, condition monitoring and analysis of climate change impacts in neighboring and/or similar countries are required. Some of

technical adaptation measures would assume, for example, certain changes in breeding (e.g. breeding transfer to deeper waters).

6.4.7. Human health

Climate change affect directly human health due to climate variabilities and extreme weather circumstances and indirectly due to impact on availability, quantity and/or quality of drinking water, ffod and air, as well as due to negative changes in individual ecosystems and infrastructure important for the quality of life. It is scientifically proved that these factors affect occurrence of new diseases, increase of frequency of existing ones, especially infectious diseases and cases of premature death, increasing the vulnerability of certain groups of people (elders, children, chronic patients, population in urban areas) and reducing the capacity of individuals and society as a whole to adapt to climate change.

According to climate scenarios, a higher incidence of hot and dry summers with maximum daily and high night temperatures (over 25°C) is expected. A more frequent occurrence of heat waves will pose a serious threat to human health in future, especially as regards elders and chronic patients. In winter, vascular patients suffer most from situations of low air pressure, the air streaming southwards and unstable weather with rain, clouds and wind.

The predicted decline in frequency of winter cold weather will cause the reduction in the number of coronary failures, cerebrovascular insults and asthmatic attacks in winter. Low air temperatures affect adversely the respiratory diseases. Asthmatic attacks are more frequent in winter during cold high-pressure periods and in other seasons, especially in summer they are associated with the movements of a cold front.

Warmer and drier conditions as projected by climate scenarios may favour the spread of diseases borne by food or water, such as diarrhoea and dysentery. A consequence of warmer summers and an extended vegetation season will be the rise in the number of patients becoming sensitized to and affected by respiratory allergies: seasonal allergic rhinitis and allergic asthma caused by pollen from the trees, grasses and weeds. It is estimated that every tenth inhabitant of the Republic of Croatia suffers from pollen allergy caused by Ambrosia (*Ambrosia artemisiifolia L.)*.

Climate changes stimulate the spread of diseases outside their natural seats. Due to global warming malaria is increasingly occurring in traditionally cool mountainous areas of Africa, Asia and South America inhabited by some 10% of the world's population. The coastal area of the Republic of Croatia might also be threatened by malaria. The tiger mosquito (*Aedes albopictus*) is spreading from South-Eastern Asia and Oceania to other continents by trade and transport of used tyres. It was recorded for the first time in the Republic of Croatia in October 2004. It spreads quite rapidly and adapts to new spaces, significant as molester as regards to health and as potential carrier of various arboviruses (among which the most important is the virus of the - VHG) and parasites.

In the Republic of Croatia the tick-borne virus meningoencephalitis, caused by a forest ticks (*Ixodes ricinus*), occurs seasonally from spring to autumn, which correlates to tick activities. A warmer and longer autumn time contributes to extension of tick activities and mild winters favour the tick survival. The rise of the annual mean temperature shifts altitudinal limit for tick occurrence.

The climate change adaptation measures and vulnerability reduction of critical groups of population include primarily the reinforcement of capacities and increase and dissemination of knowledge on risks and adverse health effects related with climate variabilities and extreme weather circumstances. It is particularly related to preventive public education on health risks and dangers of heat waves and other potentially dangerous situations.

Within the project "South East European Forum on Climate Change Adaptation (SEEFCCA)", implemented by the Croatian Red Cross, there is a report "Climate Vulnerability Assessment"[25] indicating the existing activities carried out by the Ministry of Health in cooperation with the Public Health Institutes and the World Health Organisation (WHO) in Croatia, to build the capacity of health professionals and the healthcare system:

- Lectures, round-table discussions, and workshops, held for health professionals (general practitioners, epidemiologists and public health workers) and the public, on climate change and health, including at events for World Health Day
- Leaflets, brochures, and other educational materials distributed to the public in drugstores, health institutions, and events such as World Health Day
- Advice for the public during heat waves published on the Internet and distributed to patients in health institutions
- Advice for the elderly during heat waves distributed in retirement homes and health institutions
- The MHS announcing high temperature warnings in its biometeorological forecast, and UV risk.

[25] Zaviša Šimac, Ksenija Vitale. Climate Vulnerability Assessment: Croatia. Zagreb, May 2012.

7. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY, *INCLUDING INFORMATION UNDER ARTICLES 10 AND 11 OF THE KYOTO PROTOCOL*

7.1. Provision of financial resources

Article 4, paragraph 3 of the Convention stipulates that developed country Parties and other developed Parties included in Annex II shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1. They shall also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing measurs that are covered by Article 4, paragraph 1 of the Convention.

7.2. Activities related to transfer of knowledge and technology

As Annex I country of the Kyoto Protocol with economy in transition, the Republic of Croatia has not been in a position so far to start activities related to financing transfer of knowledge and/or technologies in the field of environmental protection and climate change to developing countries. However, during the accession process to the European Union, the Republic of Croatia was beneficiary of EU funds allocated to the candidate countries and potential candidates through the horizontal component of EU programs such as regional CARDS and PHARE program and the horizontal component of the IPA multi-beneficiary program. By participating in projects in the aforementioned programmes, the Republic of Croatia has had the opportunity of indirect transfer of knowledge and experience to potential candidate countries for EU membership, which at the same time are not included in Annex I to the Convention (i.e. Bosnia and Herzegovina, Montenegro, Serbia), because the EU acquis approximation and implementation process in the field of environmental protection and climate change in the Republic of Croatia was in much advanced phase in comparison to other countries which participated in particular projects.

Below is a list of selected projects that contained component related to transfer of knowledge and experience of the Republic of Croatia in the field of environmental protection and climate change mitigation:

Project „The Regional Environmental Reconstruction Programme for South Eastern Europe - REReP“ (2002-2009)

Launched under the Stabilisation Pact for South Eastern Europe, this programme was aimed at linking the countries in the region in their joint efforts on solving environmental issues, sharing knowledge and building a proper and common network for the exchange of information.

Project „Regional Environmental Network for Accession - RENA“ (2010-2013)

The Project was continuation of REReP programme, aiming at reinforcing the cooperation between the Western Balkan countries in the environmental protection sector at the moment of accessing the European Union. The project priority field of activity was related to harmonization of environmental protection and climate legislation.

Project „Environment and Climate Regional Accession Network - ECRAN“ (2013-2016)

Since the project task is to continue with connecting and sharing knowledge and experience in the field of environmental protection and climate actions between countries in the region including Turkey, the Republic of Croatia experts included into project implementation have an opportunity of “soft“ transfer of technology regarding the climate change.

„Capacity building of Balkan countries in reporting from environment sector and development of EIONET network” (2004-2006)

The project task was to include the Western Balkan countries into activities and projects of the European Environmental Agency. The Republic of Croatia experts included into project implementation had an opportunity of “soft“ transfer of knowledge regarding the development of environmental protection indicators to the countries not being parties to the *Annex I of the Convention*.

In addition, the process of Croatian accession to the European Union affected the activities of non-governmental organizations in the environmental sector. According to the Register of Associations of the Office for Cooperation with with NGOs of the Croatian Government, there are more than 900 NGOs dealing with environmental issues.
(http://www.appluprava.hr/RegistarUdruga/faces/WEB-INF/pages/searchResult.jsp)

These NGOs have initiated or participated in the implementation of various projects whose activities contributed to the reduction of greenhouse gas emissions in the Republic of Croatia. Below is an overview of selected projects funded by the EU and other international organizations and institutions, in which Croatian representatives had the opportunity to indirectly transfer knowledge to countries not included in Annex I to the Convention

Project „Capacity building of local and regional government in the Republic of Croatia and Macedonia in EU environmental acquis“ (2007-2009)

One of the activities carried out within this project was training for future trainers concerning the implementation of European legislation on waste and water management, with specific orientation to the local and regional self-government needs.

Project „Energy saving measures in buildings at local level in Central and Eastern Europe – INTENSE“ (2008-2011)

The main results of INTENSE project were increase of partners' capacity and competence as regarding information, strategic planning and implementation of energy efficiency measures in buildings at local level.

Project “Strengthening of NGOs network for sustainable use of energy and natural resources in Western Balkans and Turkey“ (2012-2014)

One of the project activities is related to the sharing of knowledge and experience on sustainable energy use and protection of natural resources, as well as on how to increase interest in these issues in the region.

8. RESEARCH AND SYSTEMATIC OBSERVATION

8.1. Global Climate Observation System (GCOS)

Global Climate Observation System (GCOS) was established in 1992 and the Republic of Croatia, represented by the Meteorological and Hydrological Service, has been its member since then. This system includes observation in all parts of the climate system – in the atmosphere, ocean, sea and land. It is intended to define and cover all the observations required for monitoring the climate system including satellite observations at the global, regional and national levels, and to create conditions for observation enhancement.

Global Earth Observation System of Systems (GEOSS) is a new initiative taken with the objective to co-ordinate and enhance all current observing systems at the global level in support of the requirements of user areas: natural disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity. The Republic of Croatia joined the GEOSS in 2004.

8.2. Data collection and systematic observations in Croatia

8.2.1. Existing observation networks

The Republic of Croatia has a long tradition in monitoring of all segments of the climate system. The Meteorological and Hydrological Service (DHMZ – Državni hidrometeorološki zavod) is a national institution for meteorology and hydrology and has been carrying out meteorological observations for operational needs since 1851. Croatian institutions that maintain observing systems in the climate segments of atmosphere, sea and land and biodiversity are:

- Meteorological and Hydrological Service,
- State Institute for Nature Protection,
- Ministry of Maritime Affairs, Transport and Infrastructure,
- Ministry of Environmental and Nature Protection,
- Institut for Medical Research,
- Public Health Institute,
- Institute for Oceanography and Fisheries,
- Croatian Hydrographic Institute,
- "Ruđer Bošković" Institute,
- "Andrija Mohorovičić" Geophysical Institute,
- Croatian Forest Research Institute.

Apart from the institutions listed, numerous institutions and sectors of economy run their own systematic or sporadic observations. Table 8.2-1-1 shows all stations in Croatia for obseration of climate system segments including national contributions to observation of: surface-based and upper-air atmospheric essential climate variables, atmospheric composition, oceanic and terrestrial domain essential climate variables.

Tablica 8.2.1-1: National contributions to observation of: the surface-based and the upper-air atmospheric essential climate variables, the atmospheric composition, the oceanic and the terrestrial domain essential climate variables

Contributing networks specified in the GCOS implementation plan	**ECVs (Essential climate variables)**	**Number of stations or platforms currently operating**	**Number of stations or platforms operating in accordance with the GCMP (Global Climate Monitoring Principles)**	**Number of stations or platforms expected to be operational in 2020**	**Number of stations or platforms providing data to the international data centres**	**Number of stations or platforms with complete historical record available in international data centres**
GCOS Surface Network (GSN)	Air temperature	158	120	160	40	40
	Precipitation	366	250	350	40	40
Full World Weather Watch/Global Observing System (WWW/GOS) surface network	Air temperature, air pressure, wind speed and direction, water vapor, precipitation	40	40	150	40	40
Baseline Surface Radiation Network (BSRN)	Sunshine duration	40	40	50	20	20
Solar radiation and radiation balance data	Surface radiation	10	10	20	5	5
Ocean drifting buoys	Air temperature, air pressure	0	0	5	0	0
Moorded buoys	Air temperature, air pressure	2	2	7	1	1

Voluntary Observing Ship Climate Project (VOSClim)	Air temperature, air pressure, wind speed and direction, water vapor	5	5	10	5	5
Ocean reference Mooring Network and sities on small isolated islands	Air temperature, air pressure, wind speed and direction, air pressure, precipitation	5	5	10	3	3
GCOS Upper Air Network (GUAN)	Upper-air temperature, wind speed and direction, water vapour	1	1	1	1	1
Full WWW/GCOS Upper Air Network	Upper-air temperature, wind speed and direction, water vapour	2	2	2	2	2
World meteorological organization/Atmosphere Watch (WMO/GAW), Global Atmospheric CO_2 & CH_4 Monitoring Network	Carbon dioxide Methane Other greenhouse gaseous	1 0 5	1 0 5	5 0 10	0 0 5	0 0 5
WMO/GAW ozone sonde network	Ozone	0	0	0	0	0
WMO/GAW Aerosol Network	Aerosol optical depth Other aerosol properties	0 15	0 15	1 20	0 5	0 5

Global Sea Level Observing System (GLOSS) Sea-level network	Sea level	10	10	15	5	5
Argo Network	Temperature, salinity, current	2	2	5	1	1
GCOS baseline river discharge network	River discharge	300	300	350	50	50
WWW/GOS synoptic network	Snow cover	40	40	100	40	40

8.2.2. Modernization of DHMZ meteorological observation network

Meteorological observations deal with two kinds of data - visual observations of weather phenomena and instrumental data. Some observations began in Croatia in the first quarter of 19th century. Currently, DHMZ is operating mainly manually, i.e. by observers at: 41 main meteorological, 117 climatological, 336 precipitation and 23 rain storage stations (Figure 8.2.2-1). Partially automated weather stations (AWS) are co-located at 32 main meteorological station sites, and 26 non-completed AWS are installed at other locations. Spatial distribution of AWS network is represented in Fig. 8.2.2-2a and temporal evolution of AWS network is represented in Fig. 8.2.2-2b). Standard measurement time resolution at existing AMS is 10 minutes with the same potential of transmission. Terrestrial observations (such are: soil temperature, soil moisture, pan evaporation, and solar radiation measurements) are co-located at 19 main meteorological stations. DHMZ still takes care of the two radio-sounding systems in Zagreb and Zadar, 2 Doppler S-band + 6 small S-band weather radars and one sodar.

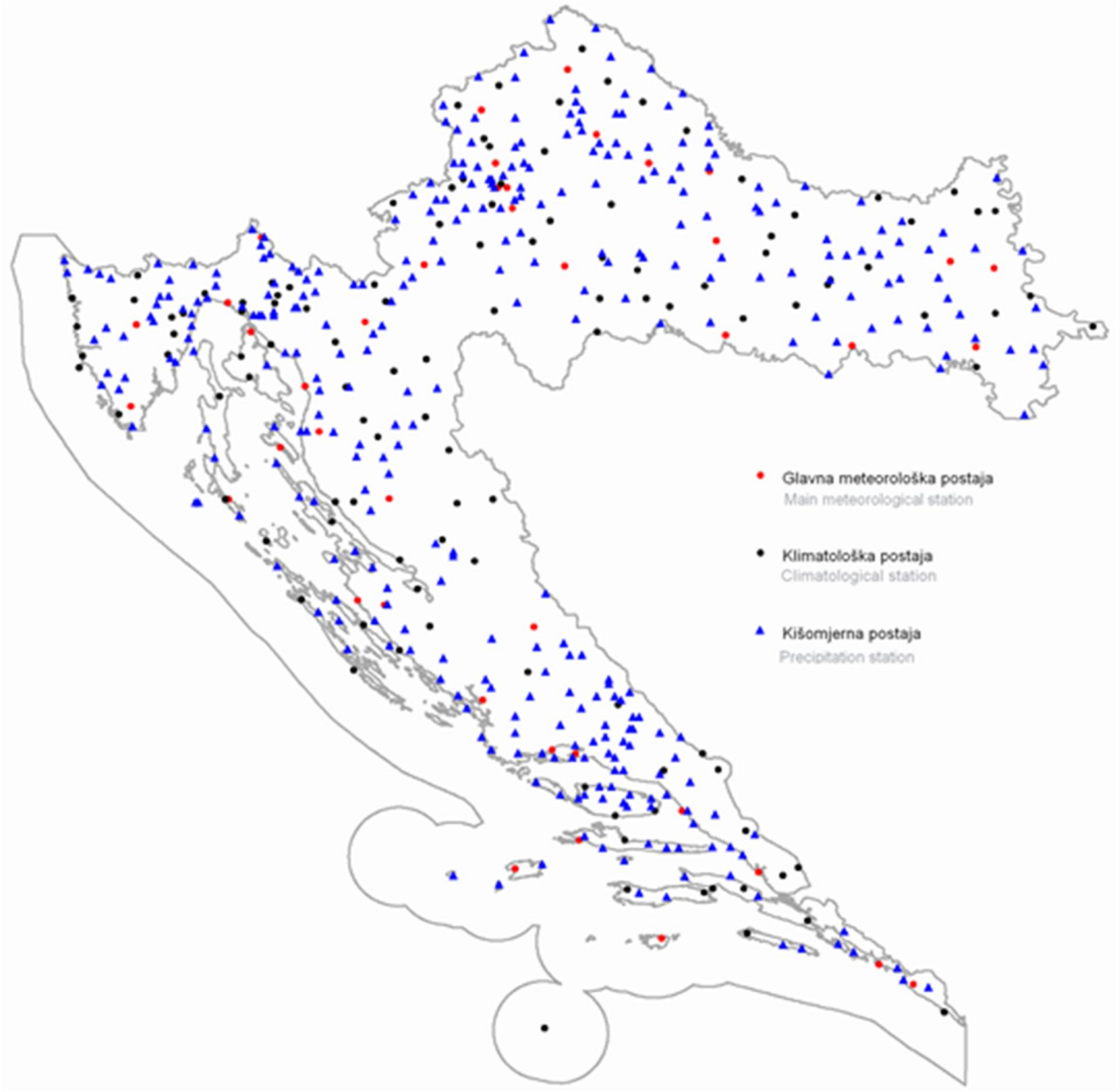

Figure 8.2.2-1. Distribution of conventional meteorological stations in Croatia

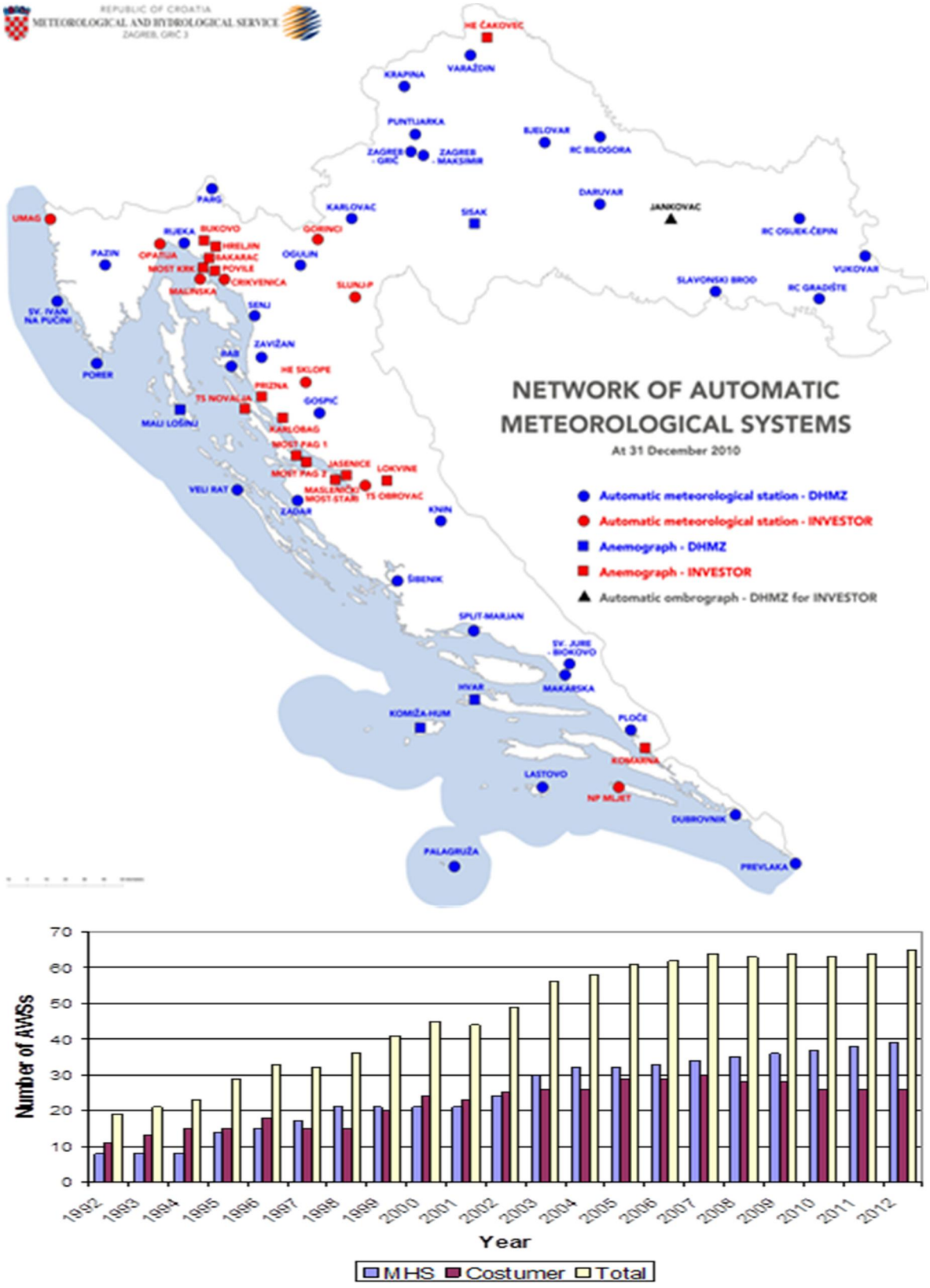

Figure 8.2.2-2 a) Distribution of AWS in Croatia and b) Development of AWS network in Croatia

Cost benefit analysis indicates that futher development of is justified as investment of 1USD results up to 7 USD benefit for society.

Despite a respectable number of meteorological stations cited and data collected there is necessity for serious modernization of existing surface and upper air meteorological network what includes modernization existing and installation of new ones: 36 main meteorological stations, 116 climatological stations, 320 rainfall stations, 6 marine stations, 2 radio-sounding stations, 3 wind profilers, 3 lidars as well as 6 weather radars (Figure 8.2.2-3).

Data obtained from the meteorological stations network modernised in this way (both surface and upper air) would serve the numerous purposes such as: monitoring and evaluation of long range transboundary pollutions; analysis and implementation of modelling techniques in terms of geographical distribution of concentration (of emissions) aiming to secure the issue of warning and immediate and appropriate information if necessary when there is a risk to human health from exposure to air pollution, particularly for sensitive groups of the population; climate monitoring and climate change model calibration and testing in order to enable adequate planning and management of human environment and sustainable activity sectors; performing detailed measurements in order to understand better the impact of pollutant and to develop appropriate policies for climate addaptation and mitigation including natural (e.g. floods and drouts) and human disaster risk reduction; renewable energy production purposes etc.

Realization of meteorological observation network modernization is realistic as the project *Modernization of meteorological and hydrological observation networks* has been recognized as priority by Ministry for Environmental and Natural Protection in its operative programme for environment, within thematic objective adaptation on climate changes of European Union within financial period 2014-2020 from which a cofinancing is expected.

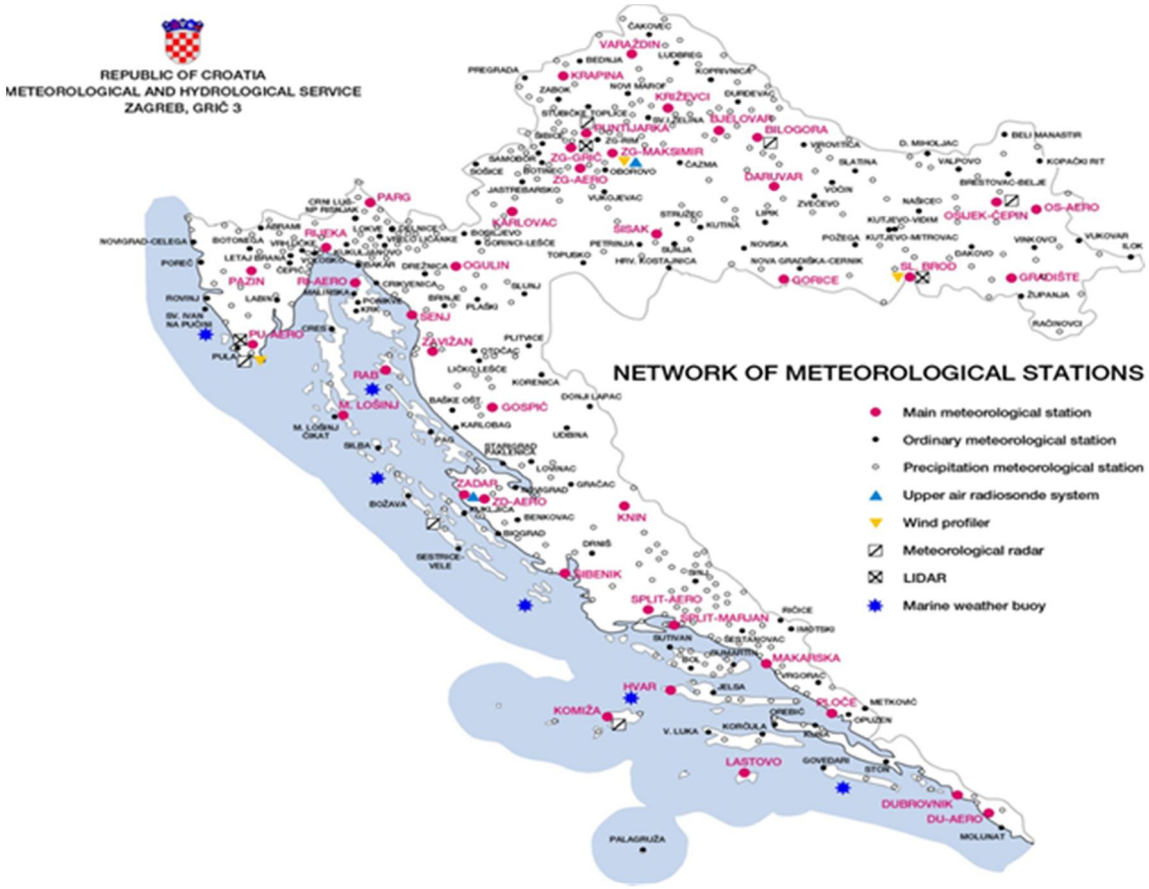

Figure 8.2.2-3 Expected modernized meteorological observation network in Croatia expected to be cofinanced by European Union fund for the period 2014-2020

8.3. Impact and adaptation to climate change by sectors

8.3.1. Hydrology and water resources

The assessment of climate change impacts on waters, in a small, but from the aspect of geology and climate highly heterogeneous country as Croatia, depends on the assessment of changes in precipitation, on evapotranspiration and determination of future water requirements.

Present knowledge does not allow any precise assessment of climate change impacts in this sector. The preservation and development of water resources and agrotechnical systems, including the application of the water management strategy, are necessary preconditions for adaptation and factors that the economic progress of the state depends upon.

Extreme hydrological phenomena such as floodings, for example, are unavoidable, but the consequences may be mitigated. A single large flood may cause damage equivalent to 30-years investment in flood defence. A new strategic approach requires further investments in flood defence and an integrated approach to water resources management. Droughts are not a sporadic phenomenon. In Croatia the shortage of water is expected in the long run during the vegetation period and the tourist season, when water requirements reach their peak. It is therefore

recommended to carry out research and to cooperate with other countries whose positive experiences in combating drought may be applied.

DHMZ as the central institution for meteorological and hydrological observations and data processing is currently undertaking research on the following topics[26]:

- Dynamical downscaling of climate change scenarios from the EH5OM global model: simulations for two 30-year periods, present climate (1961-1990) and future climate (2041-2070),
- Estimation of present and future water cycles e.g. rainfall, evapotranspiration, surface runoff, particularly for the Mediterranean area,
- Occurrence and changes of extreme weather events, notably droughts and rainfall,
- Occurrence and changes in the amount and variability of seasonal and annual precipitation,
- Changes in the frequency and intensity of heavy precipitation events.

The civil engineering and geophysics departments of the Universities of Zagreb, Osijek and Split also undertake hydrological and other water-related research. Some of this research deals with climate change related issues, including:

- The analysis of the change of the water temperature regime of Croatian rivers and changes in water flows,
- Spatial comparison, variability and trends of water balance components,
- Calculation of future climate water balance –computed from the data produced from climate scenario models.

In hydrology and water resources sector following research activities related to climate change impacts and adaptation are proposed. First, it is necessary to develop the capacity to simulate the physical impacts of climate on the supply, distribution and quality of freshwater resources. Many of the same databases and models that are needed to simulate the physical impacts of climate change are also needed to cope with existing climate variability.

The capacity to simulate the water-related impacts of climate variability and change should be strengthened in the following ways:

- Improve the ability to downscale GCM results to the level of catchments - making the results suitable for correlation with data from existing runoff gauges and weather stations used for monitoring,
- Develop a national database and system of rainfall-runoff models to project the effects of rainfall changes (for climate variability and climate change) on runoff and discharges (including peak and low flows). This should be done in important river basins and catchments and linked to an expanded national runoff and flooding reporting system,
- Improve the capacity of HEP to simulate systems operations based on improved rainfall runoff and hydropower simulation models at all existing hydro sites,
- Undertake selected, multi-agency hydrologic and ecological studies to simulate the impacts of climate variability and climate change on ecosystems that may be endangered by reductions in runoff or declining groundwater levels,
- to undertake a programme to map existing groundwater resources in a comprehensive fashion, and then develop the databases and models needed to simulate the effects of

[26] Human Development report – Croatia 2008 „A Climate for Change“ Climate change and its impacts on society and economy in Croatia, UNDP, 2008.

climate variability and climate change on groundwater recharge, storage and water quality.

8.3.2. Forestry

The response of forest ecosystems to expected climate changes will be investigated by monitoring systematically:

- phenological manifestations of leaf unfolding, flowering, fruit-bearing, leaf-losing of certain characteristic tree species and the overall duration of the vegetation period,
- emergence, activities and number of certain forest pests,
- leaves falling of crowns of major tree species,
- incidence of forest fires,
- changes in the floristic composition of urban forests,
- groundwater level oscillations,
- frequency and scope of occurrence of certain plant diseases,
- frequency of stormy weather and range of forest damages caused by wind,
- selected biological, physical and chemical variables of forests ecosystems, especially in zones of physical contact between the Mediterranean and continental climate,
- adaptation of individual provenances of forest tree species in provenance tests.

An efficient monitoring is only possible within the framework of a system for funding scientific and research projects of national importance and in cooperation with scientific institutions of neighbouring countries so as to ensure the coverage of an as wide as possible area of possible climate change effects.

The following research projects are recommended for implementation:

- Research of carbon absorption from the atmosphere into the biomass,
- Carbon uptake by forest soils,
- Modelling changes in forest ecosystems of Croatia under the influence of climate
- change,
- Natural regeneration of forests under the conditions of exposure to harmful impacts,
- Monitoring climate changes in testing the provenance of domestic and foreign forest
- tree species,
- Forest pests as an indicator of changed climate conditions.

Changes in forest ecosystems that occurred under the influence of climate changes may be monitored and quantified by a direct long-term monitoring of selected biological, physical and chemical variables *in situ*. Since a permanent long-term monitoring cannot cover all forest ecosystem types in Croatia it is recommended to monitor:

- forest types in zones of physical contact of the Mediterranean and continental climate,
- forest types on the tree-line in physical contact with mountain grasslands,
- forest types in which vulnerable species dominate (e.g. *Abies alba*),
- lowland forest types dependent upon additional wetting by floods and groundwater.

8.3.3. Agriculture

In the agricultural sector it is necessary to develop educational programmes for farmers, advising services, administrative staff, scientists, teachers and other stakeholders, and encourage Croatian scientists to participate in the work that is carried out at EU level (*JRC Ispra*, *Institute for Environment and Sustainability*, *MARS unit*, *AGRI4CAST system*, *MARS Crop Yield Forecasting System* (MCYFS)), as well as provide training for using the results of existing platforms (AVEMAC Project - *Assessing Agriculture Vulnerabilities for the design of Effective Measures for Adaption to Climate Change*, EDO - *European Drought Observatory*).

In addition, Croatia should promote the use of computer models (DSSAT - Decision Support System for Agrotechnology Transfer, WOFOST - WOrld FOod STudies, i dr.) aimed at forecasting the yield of different crops in the present conditions, but also in scenarios which predicte future climate conditions.

It is necessary to develop a comprehensive and sustainable financial mechanisms for adaptation of agriculture to climate change and for risks mitigation due to changes, which means more investment in science and applied research, and the training of stakeholders involved in the agricultural industry.

Also proposed are the following areas of research in agriculture:

- to initiate (finance) improvement projects focused on the development of populations and varieties adapted to soil types and climate conditions in Croatia's agricultural regions that will meet new requirements in the future,
- to initiate permanent research into existing agricultural crops (maize, wheat, potato, apple, wine grape) in the areas of Croatia or abroad (through international cooperation) containing already elements of the model predicted,
- to investigate new systems of tillage, sowing (planting), sowing density, cultivation forms and fertilization that will maximally economize on humidity in the soil.

8.3.4. Biodiversity and natural terrestrial ecosystems

The assessment of climate change impacts on terrestrial ecosystems is based on two groups of data: climatic prognostic models of global changes relating to the given area and data on terrestrial ecosystems in the widest context. For the purpose of overcoming the shortage of adequate amounts and quality of data on thematic areas of biodiversity and natural terrestrial ecosystems it is necessary:

- to develop climate change models under one or more selected scenarios specifically for the area of Croatia, respecting national climatic and orographic peculiarities and applying sufficient resolution of basic data for the entire national territory (approx. 100 m pixel),
- to map current distribution of target indicator flora and fauna groups using the adequate methodology as a basis for monitoring changes and developing prognostic models,
- to increase resolution of Croatia's map of habitats from a scale of 1:100 000 to a scale of 1:25 000 as a basis for monitoring changes and for predictive models,
- to monitor the development, to acquire and apply in time the latest methodological achievements in the field of ecological modelling with the aim to develop as reliable prognostic scenarios as possible,
- to map the distribution and determination of areals in Croatia for target indicator groups of flora and fauna,

- to evaluate appropriateness of migratory ways for the most threatened flora and fauna taxa,
- to evaluate the migration of invasive flora and fauna taxa on the national territory,
- to establish a seed-bank for keeping the collected plant seed material and to collect samples of animal taxa, all this for the purpose of conserving the gene fund of endemic and vulnerable plant and wildlife taxa.

8.3.5. Coast and coastal zone

Estimates of the expected rates of sea-level rise are very uncertain. That coupled with the fact that sea-level rise will probably occur very gradually means that there is still time to develop the best methods for coping with the problem, locality by locality. A mixture of short- and long-term strategies involving both protection and retreat measures could be the best approach.

Of the ongoing research activities, project "Integration of impacts of climate variabilities and changes in the integrated management of coastal areas" should be mentioned. Project is implemented by PAP/RAC in Split, in cooperation with the Plan Blue from France.

Activities to be planned and implemented in this sector include:

- improvement of institutional capacity of Croatia to comprehensively plan and manage coastal resources in a consistent manner,
- actively developing the capacity to formulate alternative policies, measures and projects for adapting to potential sea-level rise and assessing the benefits and costs of these options on an ongoing basis, as better information becomes available,
- more comprehensive and detailed mapping of its coastlines, their physical characteristics, and use patterns, and economic activities to achieve this,
- cooperation with existing agencies, institutions and centres of research expertise that are developing global and regional databases, as well as models for forecasting sea-level rise, physical and economic damages and the benefits and costs of alternative adaptation options,
- Developing the institutional capacity to formulate and implement policies, measures, and projects to protect Croatia's most valuable coastal assets, supported by the capacity to assess and compare all the benefits and costs of the alternatives for adapting to sea-level rise.

8.3.6. Marine ecosystems and fish resources

The following activities are recommended in this sectors:

- implementation of multidisciplinary oceanographic and hydrographic research into the Adriatic Sea and identification of the process of interaction between the climate and marine ecosystems,
- ongoing investigation of changes in the composition, number and food web structure of Adriatic fish and other marine organism populations,
- Monitoring of fluctuations in commercial catches for the purpose of preparing an action plan for the adaptation of Croatia's fishing sector to climate changes,
- Establishment of a permanent monitoring system for fish species that are biological indicators of changes in the hydrographic properties of the sea, with the ultimate goal of understanding their biology and ecology. It will be necessary to analyse the links to

global climate changes and their atmospheric and oceanographic consequences further, especially the increased temperature observed worldwide, which can strongly influence fish species,
- Promotion of adaptive fishery management in order to initiate a faster response to dramatic local changes, such as those reported in the Neretva River estuary,
- Analysis of previous studies on the impact of global climatic change on the fishing sector of southern Mediterranean countries (such as Turkey and Greece) in order to prepare scenarios for the Adriatic Sea and to learn from their experiences and management strategies.

8.3.7. Human health

The investigation into the connection between individual meteorological parameters and the incidence of hospitalization of patients with cerebrovascular insult and myocardial infarction in Zagreb hospitals and the monitoring of blood coagulation parameters showed the adverse effect of cold winter periods and summer situations with warm and sulky weather.

Meteorological and aerobiological parameters affect mostly the incidence of symptoms with pulmonary and cardiovascular patients. It is therefore of utmost importance to provide timely information on the atmospheric state and effects of such a state on the organism.

Biometeorological researches have been performed in Croatia for some 50 years now. Since 2004 the Meteorological and Hydrological Service has started to perform biometeorological forecast for the whole Croatian area. Biometeorological forecast is monitoring the atmosphere parameters impacts on human health and daily public informing on expected meteorological conditions with a purpose to give certain advice on health protection and symptoms prevention. Bioforecasts regularly appear in daily press and radio and television news broadcasts.

Pollen calendars provide information on the presence of (especially increased) concentrations of pollen of alergogenic plants in the air of a specific climate area based on data obtained by measuring continuously pollen concentrations in the air at measuring stations. Meteorological parameters mostly affecting a dynamics of pollen presence in the air are temperature and precipitation. Rapid warming will stimulate pollen creation and discharge into the atmosphere, while during the precipitation period it will not almost be present in the air at all. This enables the patients to adapt their activities and thus minimize the contact with allergens.

9. EDUCATION, TRAINING AND PUBLIC AWARENESS

9.1. Institutional arrangement of education

System of education in the Republic of Croatia consists of pre-school education, primary education, secondary education and higher education. Ministry of Science, Education and Sports, which is in charge of institutional education, holds a position that environmental awareness of students should be developed, and environmental education conducted, through the entire system of education. Education on climate change does not exist as a separate topic or activity but is already contained within the environmental education or in the summarized form in some of the regular subjects.

In line with the aforesaid, the Sustainable development programme has been implemented in pre-school education, where children learn about coexistence with nature, with every man, and all with the aim of developing ecological awareness in children. The curriculum for primary schools in the Republic of Croatia stipulates programmes of mandatory and optional subjects as well as guidelines for other forms of educational work in primary schools. Education for environment and sustainable development is a school activity integrated into classes and other forms of work. Students acquire the knowledge about climate change through regular lessons within the subjects: nature and society, nature, biology, chemistry and geography, as well as through numerous extracurricular activities.

Projects and programmes on the subject of environmental protection and sustainable development, such as the international programmes *GLOBE* and *SEMEP*, Eco-Schools project, national programme *Young rangers* and the like, give the theme and content framework for the activities of environmental education, enable the networking of schools with similar interests and provide mutual support and sharing of experiences.

Since 1995, 130 schools in the Republic of Croatia, whose students perform regular and continuous measurements and observations in the immediate school environment, have been included in the scientific and educational programme Global Learning and Observations to Benefit the Environment (GLOBE). Measurements and observations are being performed related to atmosphere, water, soil and cover, and the research results are mutually interconnected and complementary, thereby accomplishing a programme of comprehensive environmental monitoring. The application of information technology allows connection and exchange of information between more than 23,000 schools in 111 countries around the world.

International Eco-schools is a programme operated by the Foundation for Environmental Education (FEE), recognized as one of the most successful models of environmental education in the world. National coordinator and supervisor of the Eco-Schools programme is the association Lijepa naša. The programme includes more than 300 primary and secondary schools, dormitories and kindergartens in the Republic of Croatia, and so far the status of the international Eco-School has been earned by 226 schools.

Education and Teacher Training Agency holds annual gatherings of biologists, chemists and geographers on the subject of sustainable development. The issue of climate change is addressed in the context of other topics. The Agency has promoted competences for sustainable development (according to UNECE) through the National education curriculum and Civic education (a curriculum that is currently in the experimental implementation was prepared in the

meantime). Agency's experts have concluded that the focus should be placed on the development of competences (civic competence, critical thinking, ability of finding and evaluating information, clarifying values and viewpoints, communication, creativity, complex thinking).

With these objectives, the Agency began a modular professional development of teachers in 2011, based on the curriculum that was experientially put in practice, developed and shaped by working on a project of training the instructors for ESD with the Austrian Kultur-kontakt in the period 2008-2010. Currently, there are about 10 groups of participants of this modular seminar who have completed module 3 and module 2, and, in January 2014, module 4 will be launched. Participants develop their school projects according to quality criteria for ESD schools

In the meantime, the Agency has translated a brochure "Quality Criteria for ESD (ENSI network)", and published a "Handbook for ESD", which was a result of the work on the project with experts from Austria, now being used for education in the country. Therefore, the ESD is generally worked on, but there is no information on climate change specifically (other than information included in the classes). School projects are dealing with the saving of energy and resources at the school level by putting the alternative energy sources into operation and the like.

At the level of universities, polytechnics, scientific and research institutes and other institutions, the environmental protection, sustainable development and climate change are included in the teaching of natural, technical, biomedical and biotechnical sciences and social studies and humanities, as part of the mandatory or elective courses of undergraduate and postgraduate studies. In the period 2009-2013, observed was the increase in master's theses and doctoral dissertations concerning topics of climate change.

9.2. Education and research on climate change through project activities

Year by year, at several institutional points in the Croatian society, the number of workshops, seminars, round tables and various publications on the topic of climate change and the related issues gradually increases. Some of them are given below:

- UNDP Croatia in cooperation with MENP, based on seven workshops held during the autumn of 2012, published the "Framework for long-term low-carbon development strategy for the Republic of Croatia for the period until 2050" in May 2013. The seven workshops were attended by social actors from the state sector, civil society and businesses, and specifically from agriculture, transport, energy and industry, waste management, forestry, land management, tourism and construction sectors. The Framework offered indicators and implementing measures that would - if applied in practice in the coming years - in each of these sectors tend to lead to a reduction of anthropogenic greenhouse gas emissions. From this analytical material, the Low-carbon development strategy for the Republic of Croatia will be prepared in 2014.

- Environmental Protection Agency, as an independent public institution, collects, integrates and processes environmental data. System of clear environmental data facilitates access to the desired information to all interested parties, thereby ensuring the fulfilment of the right to timely, truthful and accurate information about the environment. Through publications, reports, website and other means, the Agency participates in

raising the awareness on various topics related to climate change. The Agency holds and constantly updates the National register of greenhouse gases.

- State Institute for Nature Protection, as an independent public institution that combines and processes data on the state of biodiversity, landscape and geological diversity, analyses and processes the technical and scientific data within its scope, providing relevant insights for preventive actions and alerts. The Institute is also continuously working to raise awareness on the need to preserve biodiversity, landscape and geological diversity.

- During the period 2009-2013, the Croatian Business Council for Sustainable Development (HR BCSD) was dealing with sustainable development in all its activities and has in many ways indirectly touched climate change issues. Furthermore, many articles on the subject of climate change, energy efficiency or renewable energy sources were published over the years by the magazine "Economy and sustainability". Round table on the topic "Using biomass as a mechanism for the implementation of commitments under the Kyoto Protocol" was organized in November 2010.

- In June 2010, for the purposes of research funded by GIZ, a research called: Situation Analysis – level of awareness and state of EE measures implementation in business sector in Croatia and Serbia was conducted.

- From the entrepreneurial circles, from individual firms there is no information on any particular focus on internal climate change education.

- In Primorje-Gorski Kotar county, the Public Institute for Spatial Planning from Rijeka, in the summer of 2011, issued a translation of the very useful book by Daniel Lerch of Post Carbon Institute, "Post Carbon Cities: Planning for Energy and Climate Uncertainty".

- MENP, especially the Division for Protection of Climate, Ozone Layer and Sea, is a pivot point of action for the national system in the area of climate change. Ministry is carrying out a series of activities related to the implementation of the obligations under the Article 6 of the Convention. It is also the competent authority for the implementation of the first two pillars of the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention). Croatia is conducting activities that are covered by this Convention. Ministry officials regularly participate in round table discussions, public presentations, radio and television shows and lectures for the public.

9.3. Work of professional institutions and professional community through providing information, public consultations and disussions

In the Republic of Croatia, there are many reputable vocational and professional institutions that have, over a long period, been implementing continuous programme and project activities related to providing information and education of professional community but also of the interested public community and business entities on climate change and the concrete mitigation measures and instruments. Particularly significant are Croatian Chamber of Economy (CCE), Croatian Business Council for Sustainable Development (HR BCSD), Croatian Employers' Association (CEA) and the Green Building Council.

In the preparation of analytical and programme documents related to climate change (adaptation plans, mitigation plans, low-carbon development strategy, etc.), education of competent public is in action in the Republic of Croatia. Number of involved members of this public increases through the work on these documents. Preparing these documents with a large share of participants is de facto a process of training the trainers. Members of this public can then be carriers of educational activities in various environments and situations in the future.

During 2012 and 2013, MENP, in cooperation with the authorized professional institution and UNDP Croatia, has prepared two documents which have undergone the intense public consultations attended by hundreds of participants, many of whom are experts in certain general and sectoral issues related to mitigation and adaptation to climate change. One is the aforementioned "Framework for long-term low-carbon development strategy for the Republic of Croatia for the period until 2050", and the other is "Plan for the protection of air, ozone layer and climate change mitigation in the Republic of Croatia for the 2013 – 2017 period".

In Šibenik-Knin county, the project "Climagine" for this county has been in progress since the spring of 2013[27]. It is being carried out by the company "Plan Blue" from Nice (FR) that has prepared the concept and Priority Actions Programme / Regional Activity Centre (PAP / RAC) from Split. The goal is to prepare the *"Plan for adaptation to climate change"* by the spring of 2014, using participatory method, and to link it closely with the "Integral Coastal Management Plan – ICMP for Šibenik-Knin county".

Both of these plans, the first two at the local level in the Republic of Croatia, gather competent public, however, through participatory method that they represent, they extend the number of members of the concerned public and may indirectly be considered to be educational projects and activities. Here, learning is achieved through practice, as a sort of "learning by doing".

Special forms of education related to climate change are also, for example, several fairs. Here we highlight the international fair of renewable energy sources in Varaždin, the oldest fair of its kind in the Republic of Croatia, which was held for the fifth time in November 2013.

9.4. Activities of NGOs

The civil sector in the field of environmental protection in the Republic of Croatia, especially some NGOs, has been intensely active in regard to topics related to climate change through education and projects during the period 2009-2013. Examples are given below.

SSD - Society for Sustainable Development is a civil society organization that deals with sustainable development, primarily in the field of energy. SSD promotes energy efficiency and renewable energy sources by working in four programme areas: 1) Raising awareness on sustainable energy; 2) Sustainable energy in the education system; 3) Supporting new initiatives for sustainable development, and 4) Strengthening political will for participatory sustainable development.

[27] The first workshop "Climagine" held in April 2013 was attended by 60 participants from the Šibenik-Knin county, and the second workshop held in November 2013 was attended by 55 participants. Through introductory lectures, discussion and participatory method of forming the indicators of climate change for this county, an interactive type of learning and education was initiated.

In the period 2009-2013, SSD has organized more than fifty public events and study trips: expert roundtable "Sustainable Energy Communities" in 2010, the national conference "Achieving Social, Environmental and Economic Sustainability through Energy Efficiency" in 2011, the international conference "Energy. Development. Democracy. Successful Approaches for a New Energy Future in South East Europe" in 2013.

Raising the level of awareness and knowledge about sustainable energy and climate change in more than 2,000 participants, it has published a series of publications ("Renewable energy sources in my community" in 2010, "FOR renewable energy sources!" in 2011, "Little school of clean energy" in 2011, etc.) and made a few short videos that explain the importance of sustainable energy development to a wide audience.

SSD established cooperation with primary schools and developed educational materials on renewable energy sources, energy efficiency and climate change for pupils (picture books and worksheets) and supporting materials for teachers, which were approved by the Agency for Education for the use in teaching the sixth grade. SSD cooperated with vocational-technical schools in the education of future renewable sources experts; two schools were equipped with didactic equipment for education on renewable sources, the proposed curriculum of the new subject "Renewable energy sources" was adopted by the Agency for Vocational Education and Training and Adult Education and is in application in several schools. Furthermore, SSD organized a course on the use of solar energy for the unemployed and participated in the launch of lifelong education in this field.

The website www.MojaEnergija.hr of the Society for Sustainable Development promotes sustainable development in all segments of society, particularly in the energy sector. The aim of the site is to educate, inform and raise awareness of all segments of the Croatian public in the energy sector, including its impact on the environment.

Climate change is a part of strategic programme of energy, transport and climate change, in which the NGO Zelena akcija was engaged from the very beginning of activities within the framework of the Energy and climate change programme, and it exists as a standalone programme since 2011.

More than 20 public advocacy actions on climate change and energy sector were organized by Zelena akcija. The organisation monitors national climate policy and comments on national legislation related to policies on energy, transport, climate change and natural resource management. It monitors and comments on international climate policy within the international delegation *Friends of the Earth International*. It has participated in the UN climate negotiations in Copenhagen and Bonn in 2009, in Cancun in 2010 and in Durban in 2011. Zelena akcija has actively participated in the establishment and operation of an international network of young people, which is principally engaged in education and public advocacy campaigns on climate change and policy (http://www.foeeurope.org/yfoee).

On June 5th 2012, the World Environment Day, the project of Zelena akcija "Solar Academy for South Eastern Europe", won the prestigious global award for sustainability awarded by the Energy Globe in cooperation with United Nations agencies UNEP, UNIDO and UNICEF. 6,000 projects were competing and 151 projects from 151 countries have received the award (www.energyglobe.info).

Particular importance among organizations that advocate solarisation of the Republic of Croatia, by constantly conceptually linking it to climate change, has HSUSE - Croatian professional association for solar energy from Zagreb. For years, this association has been systematically publishing the journal "Solar technology" as well as professional books on the topic of solar energy.

Croatian Association for reducing the carbon footprint - $HUCO_2$ began working on education of the plant operator in the scheme for greenhouse gas emission allowance trading, in terms of preparing plans for monitoring greenhouse gas emissions in accordance with the new obligations for the period 2013-2020.

9.5. Public awareness

Daily and weekly newspapers in Croatia cover various areas of environmental protection; they occasionally write about climate and climate change, adverse effects of natural disasters (drought, heat, floods, storms), the use of renewable energy sources and biofuels, and international commitments and activities of the Republic of Croatia in the implementation of the Convention and the Kyoto Protocol. Radio and television stations in the news, scientific and educational programmes occasionally provide information on climate issues. Important websites launched with the aim of informing, education, exchange of information on climate change and related issues (sustainable development, energy, energy efficiency, renewable energy sources, etc.):

As part of the MENP's website www.mzoip.hr, launched was "Save the Climate" klima.mzopu.hr website on climate change and review of all activities and projects carried out for the purpose of their mitigation.

The website of the Environmental Protection and Energy Efficiency Fund www.fzoeu.hr provides information on fees paid by polluters and users of the environment, special fees paid by the owners and trustees of motor vehicles, information on the collection and use of resources available to the Fund for financing of projects, programmes and other activities in the field of environmental protection and energy efficiency. The website of the Environmental Protection Agency www.azo.hr contains, among other things, the National register of greenhouse gas emissions. Croatian Meteorological and Hydrological Service monthly, seasonally and annually informs the public, users and experts on climate evaluation on the website www.meteo.hr and by mass media releases. The website of the UNDP project "Promoting Energy Efficiency in Croatia" is located at www.energetska-efikasnost.undp.hr.

State Institute for Nature Protection through its activities contributes to the raising of the awareness on the importance of detecting climate change, its manifestations in the living world and the need for active participation of the citizens (www.dzzp.hr).

ABBREVIATIONS, TERMS AND UNITS OF MEASUREMENT

CEA	Croatian Environment Agency
GDP	Gross Domestic Product
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CCS	Carbon Capture and Storage
CO_2-eq	CO_2 equivalent emission
CRF	Common Reporting Format
DHMZ	Meteorological and Hydrological Service
ERT	Expert Review Team
ESIF	European Structural and Investemnt Funds
EU	European Union
EU ETS	European Union Emissions Trading System
FMRL	Forest Management Reference Level
FZOEU	Environmental Protecton and Energy Efficiency Fund
Gg	Giga grams, equivalent to kt
GEOSS	Global Earth Observation System of Systems
GCOS	Global Climate Observation System
GEF	Global Environment Facility
GWP	Global Warming Potential
HAA	Croatian Accreditation Agency
HEP-ESCO	Croatian Electricity Company - Energy Service Company
HBOR	Croatian Bank for Reconstruction and Development
IPCC	Intergovernmental Panel on Climate Change
kt	Kilo tonnes (1000 tonnes)
LEDS	Low Emission Development Strategy
LULUCF	Land Use, Land Use Change and Forestry
Mt	Million tonnes (1000000 tonnes)
MA	Ministry of Agriculture
MCCP	Ministry of Construction and Physical Planning
ME	Ministry of Economy
MENP	Ministry of Environmental and Nature Protection
MMATI	Ministry of Maritime Affairs, Transport and Infrastructure
NIR	National Inventory Report
OG	Official Gazette
UNFCCC	United Nations Framework Convention on Climate Change

ANNEX I. SUMMARY TABLES OF EMISSION TRENDS 1990-2011

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Base year (1990)	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**20,582.79**	**69.13**	**1,451.68**	**0.37**	**114.52**	**NO**	**22,148.99**	**70.71**
A. Fuel Combustion	20,166.84	9.61	201.74	0.55	114.52	NO	20,483.11	65.40
1. Energy Industries	7,126.54	0.17	3.61	0.07	13.80	NO	7,143.95	22.81
2. Manufacturing Ind. and Constr.	5,447.30	0.48	10.08	0.09	17.96	NO	5,475.33	17.48
3. Transport	3,987.25	1.55	32.56	0.24	50.17	NO	4,069.97	12.99
4. Comm./Inst., Resid., Agricult.	3,605.76	7.40	155.50	0.16	32.59	NO	3,793.85	12.11
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	415.95	59.52	1,249.94	NO	NO	NO	1,665.89	5.32
1. Solid Fuels	NO	NO	48.76	NO	NO	NO	48.76	NO
2. Oil and Natural Gas	415.95	57.20	1,201.18	NO	NO	NO	1,617.13	5.16
2. Industrial Processes	**2,417.36**	**0.78**	**16.45**	**2.59**	**804.08**	**947.58**	**4,185.46**	**13.36**
A. Mineral products	1,315.38	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,315.38	4.20
B. Chemical Industry	870.99	16.45	16.45	2.59	804.08	NO	1,691.52	5.40
C. Metal Production	230.99	NE,NO	NE,NO	NO	NO	936.56	1,167.56	3.73
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	11.01	11.01	0.04
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**80.21**	**NO**	**NO**	**NE**	**NE**	**NO**	**80.21**	**0.26**
4. Agriculture	**NO**	**69.42**	**1457.81**	**9.26**	**2,870.60**	**NO**	**4,328.40**	**13.82**
A. Enteric Fermentation	NO	58.54	1,229.36	0.00	0.00	NO	1,229.36	3.92
B. Manure Management	NO	10.88	228.44	1.22	378.74	NO	607.18	1.94
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	8.04	2,491.86	NO	2,491.86	7.96
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NE,NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-4,184.93**	**0.00**	**0.01**	**0.00**	**0.00**	**NO**	**-4,184.92**	**-13.36**
A. Forest Land	-4,184.93	0.00	0.01	0.00	0.00	NO	-4,184.92	-13.36
B. Cropland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.09**	**23.81**	**499.94**	**0.25**	**78.69**	**NO**	**578.72**	**1.85**
A. Solid Waste Disposal on Land	NE,NO	10.53	221.21	0.00	0.00	NO	221.21	0.71
B. Waste Water Handling	0.00	13.27	278.73	0.25	78.69	NO	357.42	1.14
C. Waste Incineration	0.09	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.09	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**18,895.52**	**163.14**	**3,425.89**	**12.48**	**3,867.89**	**947.58**	**27,136.87**	**86.64**
Total Emissions without LULUCF	**23,080.45**	**163.14**	**3,425.89**	**12.48**	**3,867.89**	**947.58**	**31,321.79**	**100.0**
Share of Gasses in Total Emiss./Remov.	**69.63**		**12.62**		**14.25**		**100.00**	
Share of Gasses in Total Emissions	**73.69**		**10.94**		**12.35**		**100.00**	
Memo Items:								
International Bunkers	451.83	0.01	0.20	0.01	3.28	NO	455.31	
Aviation	343.29	0.00	0.05	0.01	3.01	NO	346.35	
Marine	108.54	0.01	0.15	0.00	0.27	NO	108.96	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	2,436.76	NO	NO	NO	NO	NO	2,436.76	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1990	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**21,233.57**	**69.31**	**1,455.52**	**0.35**	**107.40**	**NO**	**22,796.49**	**71.93**
A. Fuel Combustion	20,593.76	9.74	204.48	0.51	106.73	NO	20,904.97	65.96
1. Energy Industries	7,126.54	0.17	3.61	0.06	13.63	NO	7,143.78	22.54
2. Manufacturing Ind. and Constr.	5,842.92	0.52	10.83	0.09	18.18	NO	5,871.93	18.53
3. Transport	4,018.54	1.64	34.54	0.20	42.33	NO	4,095.41	12.92
4. Comm./Inst., Resid., Agricult.	3,605.76	7.40	155.50	0.16	32.59	NO	3,793.85	11.97
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	639.82	59.57	1,251.03	0.67	0.67	NO	1,891.52	5.97
1. Solid Fuels	NO	NO	48.76	NO	NO	NO	48.76	NO
2. Oil and Natural Gas	639.82	57.25	1,202.28	0.67	0.67	NO	1,842.76	5.81
2. Industrial Processes	**2,022.85**	**0.68**	**14.27**	**2.59**	**803.89**	**947.52**	**3,788.53**	**11.95**
A. Mineral products	1,305.19	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,305.19	4.12
B. Chemical Industry	466.01	14.27	14.27	2.59	803.89	NO	1,284.17	4.05
C. Metal Production	251.65	NE,NO	NE,NO	NO	NO	936.56	1,188.22	3.75
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	10.95	10.95	0.03
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**82.26**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**116.98**	**0.37**
4. Agriculture	**NO**	**70.03**	**1,470.54**	**9.39**	**2,910.18**	**NO**	**4,380.72**	**13.82**
A. Enteric Fermentation	NO	59.14	1,241.92	0.00	0.00	NO	1,241.92	3.92
B. Manure Management	NO	10.89	228.62	1.23	381.84	NO	610.47	1.93
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	8.16	2,528.33	NO	2,528.33	7.98
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NE,NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-6,431.43**	**0.60**	**12.50**	**0.02**	**7.71**	**NO**	**-6,411.22**	**-20.23**
A. Forest Land	-6,984.34	0.60	12.50	0.01	2.86	NO	-6,968.99	-21.99
B. Cropland	159.96	NE,NO	NE,NO	4.86	4.86	NO	164.82	NO
C. Grassland	-85.19	NE,NO	NE,NO	NE,NO	NE,NO	NO	-85.19	NO
D. Wetlands	30.00	NE,NO	NE,NO	NE,NO	NE,NO	NO	30.00	NO
E. Settlements	448.15	NE,NO	NE,NO	NE,NO	NE,NO	NO	448.15	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**25.05**	**526.15**	**0.27**	**84.57**	**NO**	**610.76**	**1.93**
A. Solid Waste Disposal on Land	NA,NO	11.55	242.62	0.00	0.00	NO	242.62	0.77
B. Waste Water Handling	0.00	13.50	283.52	0.27	84.57	NO	368.09	1.16
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**16,907.29**	**165.67**	**3,478.98**	**12.62**	**3,913.74**	**947.52**	**25,282.26**	**79.77**
Total Emissions without LULUCF	**23,338.72**	**165.07**	**3,478.98**	**12.62**	**3,913.74**	**947.52**	**31,693.47**	**100.0**
Share of Gasses in Total Emiss./Remov.	**66.87**		**13.76**		**15.48**		**100.00**	
Share of Gasses in Total Emissions	**73.64**		**10.98**		**12.35**		**100.00**	
Memo Items:								
International Bunkers	451.83	0.01	0.20	0.01	3.28	NO	455.31	
Aviation	343.29	0.00	0.05	0.01	3.01	NO	346.35	
Marine	108.54	0.01	0.15	0.00	0.27	NO	108.96	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	2,436.76	NO	NO	NO	NO	NO	2,436.76	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1991	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**15,721.99**	**62.20**	**1,306.10**	**0.24**	**74.43**	**NO**	**17,102.52**	**68.47**
A. Fuel Combustion	15,103.18	6.42	134.79	0.35	73.95	NO	15,311.91	61.30
1. Energy Industries	4,768.18	0.11	2.27	0.04	9.03	NO	4,779.47	19.14
2. Manufacturing Ind. and Constr.	4,344.22	0.41	8.58	0.06	13.36	NO	4,366.16	17.48
3. Transport	2,954.92	1.24	26.05	0.14	29.78	NO	3,010.75	12.05
4. Comm./Inst., Resid., Agricult.	3,035.86	4.66	97.89	0.10	21.77	NO	3,155.53	12.63
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	618.81	55.78	1,171.31	0.49	0.49	NO	1,790.61	7.17
1. Solid Fuels	NO	NO	43.45	NO	NO	NO	43.45	NO
2. Oil and Natural Gas	618.81	53.71	1,127.85	0.49	0.49	NO	1,747.16	6.99
2. Industrial Processes	**1,544.74**	**0.45**	**9.55**	**2.28**	**706.05**	**653.27**	**2,913.62**	**11.67**
A. Mineral products	864.23	NE,NO	NE,NO	NE,NO	NE,NO	NO	864.23	3.46
B. Chemical Industry	447.00	9.55	9.55	2.28	706.05	NO	1,162.60	4.65
C. Metal Production	233.51	NE,NO	NE,NO	NO	NO	642.44	875.96	3.51
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	10.83	10.83	0.04
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**85.68**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**120.40**	**0.48**
4. Agriculture	**NO**	**64.92**	**1,363.31**	**9.23**	**2,862.62**	**NO**	**4,225.93**	**16.92**
A. Enteric Fermentation	NO	54.23	1,138.74	0.00	0.00	NO	1,138.74	4.56
B. Manure Management	NO	10.69	224.57	1.15	354.98	NO	579.54	2.32
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	8.09	2,507.64	NO	2,507.64	10.04
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,104.42**	**0.60**	**12.50**	**0.02**	**7.54**	**NO**	**-8,084.38**	**-32.37**
A. Forest Land	-8,650.93	0.60	12.50	0.01	2.86	NO	-8,635.57	-34.57
B. Cropland	146.68	NE,NO	NE,NO	4.69	4.69	NO	151.37	NO
C. Grassland	-56.59	NE,NO	NE,NO	NE,NO	NE,NO	NO	-56.59	NO
D. Wetlands	30.17	NE,NO	NE,NO	NE,NO	NE,NO	NO	30.17	NO
E. Settlements	426.24	NE,NO	NE,NO	NE,NO	NE,NO	NO	426.24	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**25.52**	**535.88**	**0.25**	**78.91**	**NO**	**614.83**	**2.46**
A. Solid Waste Disposal on Land	NA,NO	12.09	253.95	0.00	0.00	NO	253.95	1.02
B. Waste Water Handling	0.00	13.43	281.93	0.25	78.91	NO	360.84	1.44
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**9,248.03**	**153.68**	**3,227.33**	**12.03**	**3,729.56**	**653.27**	**16,892.92**	**67.63**
Total Emissions without LULUCF	**17,352.45**	**153.09**	**3,227.33**	**12.03**	**3,729.56**	**653.27**	**24,977.30**	**100.0**
Share of Gasses in Total Emiss./Remov.	**54.74**		**19.10**		**22.08**		**100.00**	
Share of Gasses in Total Emissions	**69.47**		**12.92**		**14.93**		**100.00**	
Memo Items:								
International Bunkers	139.53	0.01	0.11	0.00	0.77	NO	140.41	
Aviation	68.19	0.00	0.01	0.00	0.60	NO	68.80	
Marine	71.34	0.00	0.10	0.00	0.18	NO	71.61	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,680.37	NO	NO	NO	NO	NO	1,680.37	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1992	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**15,038.48**	**60.97**	**1,280.31**	**0.22**	**66.77**	**NO**	**16,385.56**	**70.38**
A. Fuel Combustion	14,413.03	5.26	110.41	0.32	66.32	NO	14,589.76	62.66
1. Energy Industries	5,338.81	0.11	2.35	0.05	9.79	NO	5,350.95	22.98
2. Manufacturing Ind. and Constr.	3,680.56	0.35	7.39	0.05	10.30	NO	3,698.25	15.88
3. Transport	2,844.51	1.10	23.17	0.13	27.80	NO	2,895.48	12.44
4. Comm./Inst., Resid., Agricult.	2,549.15	3.69	77.50	0.09	18.43	NO	2,645.07	11.36
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	625.45	55.71	1,169.91	0.44	0.44	NO	1,795.80	7.71
1. Solid Fuels	NO	NO	33.77	NO	NO	NO	33.77	NO
2. Oil and Natural Gas	625.45	54.10	1,136.14	0.44	0.44	NO	1,762.03	7.57
2. Industrial Processes	**1,602.70**	**0.39**	**8.19**	**2.98**	**923.19**	**10.92**	**2,544.99**	**10.93**
A. Mineral products	932.50	NE,NO	NE,NO	NE,NO	NE,NO	NO	932.50	4.01
B. Chemical Industry	575.22	8.19	8.19	2.98	923.19	NO	1,506.59	6.47
C. Metal Production	94.99	NE,NO	NE,NO	NO	NO	NO	94.99	0.41
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	10.92	10.92	0.05
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**66.86**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**101.58**	**0.44**
4. Agriculture	**NO**	**51.17**	**1,074.54**	**8.23**	**2,551.75**	**NO**	**3,626.30**	**15.58**
A. Enteric Fermentation	NO	43.08	904.73	0.00	0.00	NO	904.73	3.89
B. Manure Management	NO	8.09	169.82	0.91	282.53	NO	452.34	1.94
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.32	2,269.23	NO	2,269.23	9.75
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,582.46**	**0.14**	**2.85**	**0.02**	**5.17**	**NO**	**-8,574.44**	**-36.83**
A. Forest Land	-9,067.56	0.14	2.85	0.00	0.65	NO	-9,064.06	-38.93
B. Cropland	137.49	NE,NO	NE,NO	4.52	4.52	NO	142.01	NO
C. Grassland	-47.84	NE,NO	NE,NO	NE,NO	NE,NO	NO	-47.84	NO
D. Wetlands	31.89	NE,NO	NE,NO	NE,NO	NE,NO	NO	31.89	NO
E. Settlements	363.57	NE,NO	NE,NO	NE,NO	NE,NO	NO	363.57	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**25.98**	**545.57**	**0.25**	**78.46**	**NO**	**624.07**	**2.68**
A. Solid Waste Disposal on Land	NA,NO	12.63	265.23	0.00	0.00	NO	265.23	1.14
B. Waste Water Handling	0.00	13.35	280.34	0.25	78.46	NO	358.80	1.54
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**8,125.62**	**138.64**	**2,911.46**	**11.69**	**3,625.33**	**10.92**	**14,708.06**	**63.17**
Total Emissions without LULUCF	**16,708.08**	**138.51**	**2,911.46**	**11.69**	**3,625.33**	**10.92**	**23,282.50**	**100.0**
Share of Gasses in Total Emiss./Remov.	**55.25**		**19.79**		**24.65**		**100.00**	
Share of Gasses in Total Emissions	**71.76**		**12.50**		**15.57**		**100.00**	
Memo Items:								
International Bunkers	137.25	0.01	0.12	0.00	0.70	NO	138.1	
Aviation	56.62	0.00	0.01	0.00	0.50	NO	57.1	
Marine	80.62	0.01	0.11	0.00	0.20	NO	80.9	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,459.04	NO	NO	NO	NO	NO	1,459.0	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1993	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	14,981.26	4.99	104.85	0.35	74.41	NO	15,160.52	64.97
A. Fuel Combustion	5,918.93	0.14	2.93	0.05	10.07	NO	5,931.93	25.42
1. Energy Industries	3,515.57	0.34	7.04	0.05	9.82	NO	3,532.42	15.14
2. Manufacturing Ind. and Constr.	3,015.56	1.09	22.82	0.18	37.12	NO	3,075.50	13.18
3. Transport	2,531.21	3.43	72.06	0.08	17.40	NO	2,620.67	11.23
4. Comm./Inst., Resid., Agricult.	NO	NO	NO	NO	NO	NO	NO	NO
5. Other	824.60	62.17	1305.59	0.45	0.45	NO	2,130.64	9.13
B. Fugitive Emissions from Fuels	NO	NO	32.31	NO	NO	NO	32.31	NO
1. Solid Fuels	824.60	60.63	1,273.29	0.45	0.45	NO	2,098.33	8.99
2. Oil and Natural Gas	**1,285.25**	**0.43**	**9.04**	**2.24**	**695.91**	**11.04**	**2,001.25**	**8.58**
2. Industrial Processes	799.69	NE,NO	NE,NO	NE,NO	NE,NO	NO	799.69	3.43
A. Mineral products	446.83	9.04	9.04	2.24	695.91	NO	1,151.78	4.94
B. Chemical Industry	38.74	NE,NO	NE,NO	NO	NO	NO	38.74	0.17
C. Metal Production	NE	NO	NO	NO	NO	NO	NE	NE
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	11.04	11.04	0.05
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	**74.02**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**108.74**	**0.47**
3. Solvent and Other Product Use	**NO**	**50.27**	**1,055.75**	**7.23**	**2,242.72**	**NO**	**3,298.47**	**14.14**
4. Agriculture	NO	41.96	881.07	0.00	0.00	NO	881.07	3.78
A. Enteric Fermentation	NO	8.32	174.68	0.89	276.21	NO	450.89	1.93
B. Manure Management	NO	NO	NO	0.00	0.00	NO	NO	NO
C. Rice Cultivation	NO	NO	NO	6.34	1,966.50	NO	1,966.50	8.43
D. Agricultural Soils	NO	NO	NO	NO	NO	NO	NO	NO
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,594.82**	**1.15**	**24.20**	**0.03**	**9.88**	**NO**	**-8,560.75**	**-36.69**
A. Forest Land	-9,109.25	1.15	24.20	0.02	5.53	NO	-9,079.52	-38.91
B. Cropland	140.48	NE,NO	NE,NO	4.35	4.35	NO	144.83	NO
C. Grassland	-60.10	NE,NO	NE,NO	NE,NO	NE,NO	NO	-60.10	NO
D. Wetlands	33.60	NE,NO	NE,NO	NE,NO	NE,NO	NO	33.60	NO
E. Settlements	400.45	NE,NO	NE,NO	NE,NO	NE,NO	NO	400.45	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**26.47**	**555.90**	**0.25**	**77.64**	**NO**	**633.58**	**2.72**
A. Solid Waste Disposal on Land	NA,NO	13.20	277.15	0.00	0.00	NO	277.15	1.19
B. Waste Water Handling	0.00	13.27	278.75	0.25	77.64	NO	356.38	1.53
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**8,570.35**	**145.49**	**3,055.34**	**10.00**	**3,101.00**	**11.04**	**14,772.45**	**63.31**
Total Emissions without LULUCF	**17,165.18**	**144.34**	**3,055.34**	**10.00**	**3101.00**	**11.04**	**23,333.20**	**100.0**
Share of Gasses in Total Emiss./Remov.	**58.02**		**20.68**		**20.99**		**100.00**	
Share of Gasses in Total Emissions	**73.57**		**13.09**		**13.29**		**100.00**	
Memo Items:								
International Bunkers	253.72	0.01	0.18	0.00	1.50	NO	255.40	
Aviation	139.18	0.00	0.02	0.00	1.22	NO	140.42	
Marine	114.54	0.01	0.16	0.00	0.28	NO	114.98	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,388.13	NO	NO	NO	NO	NO	1,388.13	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1994	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**14,958.57**	**60.80**	**1,276.71**	**0.25**	**76.41**	**NO**	**16,311.69**	**72.44**
A. Fuel Combustion	14,218.65	5.25	110.27	0.36	76.00	NO	14,404.91	63.97
1. Energy Industries	4,671.23	0.12	2.48	0.04	7.45	NO	4,681.17	20.79
2. Manufacturing Ind. and Constr.	3,700.16	0.33	6.88	0.04	9.25	NO	3,716.28	16.50
3. Transport	3,231.46	1.18	24.80	0.19	40.72	NO	3,296.97	14.64
4. Comm./Inst., Resid., Agricult.	2,615.80	3.62	76.11	0.09	18.58	NO	2,710.49	12.04
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	739.92	55.55	1,166.45	0.41	0.41	NO	1,906.77	8.47
1. Solid Fuels	NO	NO	28.97	NO	NO	NO	28.97	NO
2. Oil and Natural Gas	739.92	54.17	1,137.48	0.41	0.41	NO	1,877.80	8.34
2. Industrial Processes	**1,455.87**	**0.41**	**8.69**	**2.43**	**752.57**	**11.16**	**2,228.29**	**9.90**
A. Mineral products	968.67	NE,NO	NE,NO	NE,NO	NE,NO	NO	968.67	4.30
B. Chemical Industry	450.03	8.69	8.69	2.43	752.57	NO	1,211.29	5.38
C. Metal Production	37.17	NE,NO	NE,NO	NO	NO	NO	37.17	0.17
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	11.16	11.16	0.05
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**75.80**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**110.52**	**0.49**
4. Agriculture	**NO**	**46.29**	**972.03**	**7.25**	**2,247.09**	**NO**	**3,219.12**	**14.30**
A. Enteric Fermentation	NO	37.94	796.64	0.00	0.00	NO	796.64	3.54
B. Manure Management	NO	8.35	175.38	0.83	257.44	NO	432.82	1.92
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	6.42	1,989.65	NO	1,989.65	8.84
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,512.33**	**0.52**	**10.99**	**0.02**	**6.69**	**NO**	**-8,494.64**	**-37.72**
A. Forest Land	-9,047.00	0.52	10.99	0.01	2.51	NO	-9,033.50	-40.11
B. Cropland	143.34	NE,NO	NE,NO	4.18	4.18	NO	147.51	NO
C. Grassland	-57.91	NE,NO	NE,NO	NE,NO	NE,NO	NO	-57.91	NO
D. Wetlands	35.32	NE,NO	NE,NO	NE,NO	NE,NO	NO	35.32	NO
E. Settlements	413.93	NE,NO	NE,NO	NE,NO	NE,NO	NO	413.93	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**27.13**	**569.76**	**0.26**	**79.62**	**NO**	**649.43**	**2.88**
A. Solid Waste Disposal on Land	NA,NO	13.82	290.13	0.00	0.00	NO	290.13	1.29
B. Waste Water Handling	0.00	13.32	279.63	0.26	79.62	NO	359.25	1.60
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**7,977.96**	**135.15**	**2,838.18**	**10.20**	**3,162.38**	**11.16**	**14,024.40**	**62.28**
Total Emissions without LULUCF	**16,490.29**	**134.63**	**2,838.18**	**10.20**	**3,162.38**	**11.16**	**22,519.04**	**100.0**
Share of Gasses in Total Emiss./Remov.	**56.89**		**20.24**		**22.55**		**100.00**	
Share of Gasses in Total Emissions	**73.23**		**12.60**		**14.04**		**100.00**	
Memo Items:								
International Bunkers	326.50	0.01	0.22	0.01	1.99	NO	328.71	
Aviation	188.18	0.00	0.03	0.01	1.65	NO	189.85	
Marine	138.33	0.01	0.19	0.00	0.34	NO	138.86	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,403.18	NO	NO	NO	NO	NO	1,403.18	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1995	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**15,903.85**	**61.26**	**1,286.40**	**0.23**	**72.80**	**NO**	**17,263.04**	**74.70**
A. Fuel Combustion	15,034.38	5.41	113.56	0.34	72.40	NO	15,220.34	65.86
1. Energy Industries	5,262.45	0.14	2.93	0.05	9.58	NO	5,274.96	22.83
2. Manufacturing Ind. and Constr.	3,540.91	0.32	6.71	0.04	9.13	NO	3,556.75	15.39
3. Transport	3,405.46	1.23	25.92	0.16	34.61	NO	3,466.00	15.00
4. Comm./Inst., Resid., Agricult.	2,825.55	3.71	78.00	0.09	19.09	NO	2,922.64	12.65
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	869.47	55.85	1,172.83	0.39	0.39	NO	2,042.70	8.84
1. Solid Fuels	NO	NO	23.07	NO	NO	NO	23.07	NO
2. Oil and Natural Gas	869.47	54.75	1,149.76	0.39	0.39	NO	2,019.62	8.74
2. Industrial Processes	**1,224.15**	**0.33**	**6.99**	**2.33**	**723.70**	**61.02**	**2,015.86**	**8.72**
A. Mineral products	749.26	NE,NO	NE,NO	NE,NO	NE,NO	NO	749.26	3.24
B. Chemical Industry	438.77	6.99	6.99	2.33	723.70	NO	1,169.46	5.06
C. Metal Production	36.12	NE,NO	NE,NO	NO	NO	NO	36.12	0.16
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	61.02	61.02	0.26
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**73.62**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**108.34**	**0.47**
4. Agriculture	**NO**	**43.70**	**917.65**	**6.89**	**2,137.18**	**NO**	**3,054.84**	**13.22**
A. Enteric Fermentation	NO	36.20	760.22	0.00	0.00	NO	760.22	3.29
B. Manure Management	NO	7.50	157.43	0.78	241.97	NO	399.41	1.73
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	6.11	1,895.21	NO	1,895.21	8.20
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-9,084.88**	**0.09**	**1.87**	**0.01**	**4.44**	**NO**	**-9,078.57**	**-39.29**
A. Forest Land	-9,551.57	0.09	1.87	0.00	0.43	NO	-9,549.27	-41.32
B. Cropland	162.63	NE,NO	NE,NO	4.01	4.01	NO	166.64	NO
C. Grassland	-80.97	NE,NO	NE,NO	NE,NO	NE,NO	NO	-80.97	NO
D. Wetlands	37.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	37.04	NO
E. Settlements	348.00	NE,NO	NE,NO	NE,NO	NE,NO	NO	348.00	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**27.70**	**581.72**	**0.28**	**85.67**	**NO**	**667.44**	**2.89**
A. Solid Waste Disposal on Land	NA,NO	14.54	305.26	0.00	0.00	NO	305.26	1.32
B. Waste Water Handling	0.00	13.17	276.47	0.28	85.67	NO	362.14	1.57
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**8,116.78**	**133.08**	**2,794.63**	**9.75**	**3,023.79**	**61.02**	**14,030.94**	**60.71**
Total Emissions without LULUCF	**17,201.66**	**132.99**	**2,794.63**	**9.75**	**3,023.79**	**61.02**	**23,109.52**	**100.0**
Share of Gasses in Total Emiss./Remov.	**57.85**		**19.92**		**21.55**		**100.00**	
Share of Gasses in Total Emissions	**74.44**		**12.09**		**13.08**		**100.00**	
Memo Items:								
International Bunkers	288.76	0.01	0.17	0.01	1.89	NO	290.82	
Aviation	186.75	0.00	0.03	0.01	1.64	NO	188.42	
Marine	102.01	0.01	0.14	0.00	0.25	NO	102.40	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,452.60	NO	NO	NO	NO	NO	1,452.60	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1996	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**16,418.24**	**61.92**	**1,300.33**	**0.34**	**104.78**	**NO**	**17,823.3**	**75.05**
A. Fuel Combustion	15,574.95	6.32	132.74	0.50	104.39	NO	15,812.1	66.58
1. Energy Industries	5,110.49	0.13	2.80	0.04	8.83	NO	5,122.1	21.57
2. Manufacturing Ind. and Constr.	3,507.98	0.31	6.58	0.04	9.06	NO	3,523.6	14.84
3. Transport	3,727.43	1.33	27.94	0.30	63.48	NO	3,818.8	16.08
4. Comm./Inst., Resid., Agricult.	3,229.05	4.54	95.42	0.11	23.03	NO	3,347.5	14.10
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	843.29	55.60	1167.59	0.38	0.38	NO	2,011.3	8.47
1. Solid Fuels	NO	NO	18.61	NO	NO	NO	18.6	NO
2. Oil and Natural Gas	843.29	54.71	1148.98	0.38	0.38	NO	1992.7	8.39
2. Industrial Processes	**1,328.47**	**0.31**	**6.58**	**2.17**	**673.86**	**80.45**	**2,089.4**	**8.80**
A. Mineral products	833.60	NE,NO	NE,NO	NE,NO	NE,NO	NO	833.6	3.51
B. Chemical Industry	476.59	6.58	6.58	2.17	673.86	NO	1,157.0	4.87
C. Metal Production	18.28	NE,NO	NE,NO	NO	NO	NO	18.3	0.08
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	80.45	80.4	0.34
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**87.50**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**122.2**	**0.51**
4. Agriculture	**NO**	**41.89**	**879.69**	**6.96**	**2,158.43**	**NO**	**3,038.1**	**12.79**
A. Enteric Fermentation	NO	34.50	724.43	0.00	0.00	NO	724.4	3.05
B. Manure Management	NO	7.39	155.26	0.73	227.56	NO	382.8	1.61
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	6.23	1,930.88	NO	1,930.9	8.13
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,836.97**	**0.36**	**7.53**	**0.02**	**5.56**	**NO**	**-8,823.9**	**-37.16**
A. Forest Land	-9,303.55	0.36	7.53	0.01	1.72	NO	-9,294.3	-39.14
B. Cropland	157.28	NE,NO	NE,NO	3.84	3.84	NO	161.1	NO
C. Grassland	-94.19	NE,NO	NE,NO	NE,NO	NE,NO	NO	-94.2	NO
D. Wetlands	38.76	NE,NO	NE,NO	NE,NO	NE,NO	NO	38.8	NO
E. Settlements	364.73	NE,NO	NE,NO	NE,NO	NE,NO	NO	364.7	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**28.27**	**593.70**	**0.26**	**81.19**	**NO**	**674.9**	**2.84**
A. Solid Waste Disposal on Land	NA,NO	15.32	321.80	0.00	0.00	NO	321.8	1.36
B. Waste Water Handling	0.00	12.95	271.90	0.26	81.19	NO	353.1	1.49
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.0	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**8,997.28**	**132.75**	**2,787.83**	**9.75**	**3,023.81**	**80.45**	**14,924.1**	**62.84**
Total Emissions without LULUCF	**17,834.25**	**132.40**	**2,787.83**	**9.75**	**3,023.81**	**80.45**	**23,748.0**	**100.0**
Share of Gasses in Total Emiss./Remov.	**60.29**		**18.68**		**20.26**		**100.0**	
Share of Gasses in Total Emissions	**75.10**		**11.74**		**12.73**		**100.0**	
Memo Items:								
International Bunkers	290.93	0.01	0.19	0.01	1.83	NO	292.9	
Aviation	176.02	0.00	0.03	0.00	1.54	NO	177.6	
Marine	114.91	0.01	0.16	0.00	0.28	NO	115.4	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,734.09	NO	NO	NO	NO	NO	1,734.1	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1997	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**17,274.25**	**64.99**	**1,364.77**	**0.37**	**115.77**	**NO**	**18,754.80**	**74.52**
A. Fuel Combustion	16,478.78	6.38	134.06	0.55	115.39	NO	16,728.23	66.47
1. Energy Industries	5,593.57	0.12	2.62	0.05	10.65	NO	5,606.84	22.28
2. Manufacturing Ind. and Constr.	3,594.79	0.34	7.24	0.05	9.74	NO	3,611.77	14.35
3. Transport	4,010.17	1.41	29.54	0.34	72.05	NO	4,111.76	16.34
4. Comm./Inst., Resid., Agricult.	3,280.24	4.51	94.67	0.11	22.95	NO	3,397.86	13.50
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	795.48	58.61	1,230.71	0.39	0.39	NO	2,026.57	8.05
1. Solid Fuels	NO	NO	13.61	NO	NO	NO	13.61	NO
2. Oil and Natural Gas	795.48	57.96	1,217.09	0.39	0.39	NO	2,012.95	8.00
2. Industrial Processes	**1,508.56**	**0.28**	**5.81**	**2.28**	**708.21**	**102.85**	**2,325.44**	**9.24**
A. Mineral products	943.13	NE,NO	NE,NO	NE,NO	NE,NO	NO	943.13	3.75
B. Chemical Industry	517.83	5.81	5.81	2.28	708.21	NO	1,231.85	4.89
C. Metal Production	47.61	NE,NO	NE,NO	NO	NO	NO	47.61	0.19
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	102.85	102.85	0.41
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**78.52**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**113.24**	**0.45**
4. Agriculture	**NO**	**41.61**	**873.86**	**7.76**	**2,404.80**	**NO**	**3,278.66**	**13.03**
A. Enteric Fermentation	NO	34.35	721.36	0.00	0.00	NO	721.36	2.87
B. Manure Management	NO	7.26	152.50	0.72	223.66	NO	376.16	1.49
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.04	2,181.14	NO	2,181.14	8.67
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,281.55**	**0.57**	**11.88**	**0.02**	**6.39**	**NO**	**-8,263.27**	**-32.83**
A. Forest Land	-8,756.02	0.57	11.88	0.01	2.72	NO	-8,741.42	-34.73
B. Cropland	160.35	NE,NO	NE,NO	3.67	3.67	NO	164.02	NO
C. Grassland	-89.27	NE,NO	NE,NO	NE,NO	NE,NO	NO	-89.27	NO
D. Wetlands	40.47	NE,NO	NE,NO	NE,NO	NE,NO	NO	40.47	NO
E. Settlements	362.92	NE,NO	NE,NO	NE,NO	NE,NO	NO	362.92	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**29.20**	**613.11**	**0.26**	**81.55**	**NO**	**694.71**	**2.76**
A. Solid Waste Disposal on Land	NA,NO	16.20	340.30	0.00	0.00	NO	340.30	1.35
B. Waste Water Handling	0.00	12.99	272.81	0.26	81.55	NO	354.36	1.41
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**10,579.83**	**136.64**	**2,869.44**	**10.70**	**3,316.73**	**102.85**	**16,903.57**	**67.17**
Total Emissions without LULUCF	**18,861.38**	**136.07**	**2,869.44**	**10.70**	**3,316.73**	**102.85**	**25,166.85**	**100.0**
Share of Gasses in Total Emiss./Remov.	**62.59**		**16.98**		**19.62**		**100.00**	
Share of Gasses in Total Emissions	**74.95**		**11.40**		**13.18**		**100.00**	
Memo Items:								
International Bunkers	263.80	0.01	0.13	0.01	1.85	NO	265.78	
Aviation	190.17	0.00	0.03	0.01	1.67	NO	191.87	
Marine	73.63	0.00	0.10	0.00	0.18	NO	73.92	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,793.72	NO	NO	NO	NO	NO	1,793.72	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1998	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**18,111.63**	**57.29**	**1,203.14**	**0.30**	**92.46**	**NO**	**19,407.22**	**76.60**
A. Fuel Combustion	17,403.51	6.16	129.41	0.44	92.10	NO	17,625.01	69.56
1. Energy Industries	6,272.23	0.14	2.88	0.06	11.67	NO	6,286.78	24.81
2. Manufacturing Ind. and Constr.	3,770.72	0.34	7.10	0.05	9.85	NO	3,787.68	14.95
3. Transport	4,219.35	1.45	30.39	0.23	49.12	NO	4,298.87	16.97
4. Comm./Inst., Resid., Agricult.	3,141.20	4.24	89.03	0.10	21.45	NO	3,251.69	12.83
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	708.12	51.13	1,073.73	0.36	0.36	NO	1,782.21	7.03
1. Solid Fuels	NO	NO	14.26	NO	NO	NO	14.26	NO
2. Oil and Natural Gas	708.12	50.45	1,059.47	0.36	0.36	NO	1,767.95	6.98
2. Industrial Processes	**1,435.11**	**0.28**	**5.83**	**1.72**	**533.19**	**130.76**	**2,104.88**	**8.31**
A. Mineral products	1017.32	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,017.32	4.02
B. Chemical Industry	388.43	5.83	5.83	1.72	533.19	NO	927.44	3.66
C. Metal Production	29.36	NE,NO	NE,NO	NO	NO	NO	29.36	0.12
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	130.76	130.76	0.52
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**76.87**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**111.59**	**0.44**
4. Agriculture	**NO**	**41.08**	**862.71**	**6.91**	**2,143.02**	**NO**	**3,005.73**	**11.86**
A. Enteric Fermentation	NO	33.93	712.46	0.00	0.00	NO	712.46	2.81
B. Manure Management	NO	7.15	150.25	0.70	217.88	NO	368.13	1.45
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	6.21	1925.14	NO	1,925.14	7.60
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,196.33**	**1.06**	**22.29**	**0.03**	**8.60**	**NO**	**-8,165.44**	**-32.23**
A. Forest Land	-8,680.36	1.06	22.29	0.02	5.10	NO	-8,652.97	-34.15
B. Cropland	178.77	NE,NO	NE,NO	3.50	3.50	NO	182.27	NO
C. Grassland	-103.01	NE,NO	NE,NO	NE,NO	NE,NO	NO	-103.01	NO
D. Wetlands	42.19	NE,NO	NE,NO	NE,NO	NE,NO	NO	42.19	NO
E. Settlements	366.07	NE,NO	NE,NO	NE,NO	NE,NO	NO	366.07	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**29.90**	**627.99**	**0.26**	**79.52**	**NO**	**707.55**	**2.79**
A. Solid Waste Disposal on Land	NA,NO	17.13	359.75	0.00	0.00	NO	359.75	1.42
B. Waste Water Handling	0.00	12.77	268.24	0.26	79.52	NO	347.76	1.37
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**11,427.31**	**129.62**	**2,721.95**	**9.22**	**2,856.79**	**130.76**	**17,171.53**	**67.77**
Total Emissions without LULUCF	**19,623.64**	**128.56**	**2,721.95**	**9.22**	**2,856.79**	**130.76**	**25,336.97**	**100.0**
Share of Gasses in Total Emiss./Remov.	**66.55**		**15.85**		**16.64**		**100.00**	
Share of Gasses in Total Emissions	**77.45**		**10.74**		**11.28**		**100.00**	
Memo Items:								
International Bunkers	287.83	0.01	0.14	0.01	2.01	NO	289.98	
Aviation	206.83	0.00	0.03	0.01	1.81	NO	208.67	
Marine	81.00	0.01	0.11	0.00	0.20	NO	81.31	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,678.97	NO	NO	NO	NO	NO	1,678.97	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 1999	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**18,667.94**	**56.12**	**1178.53**	**0.45**	**138.27**	**NO**	**19,984.74**	**75.07**
A. Fuel Combustion	17,976.50	5.92	124.39	0.66	137.93	NO	18,238.83	68.51
1. Energy Industries	6,467.65	0.14	2.94	0.06	11.81	NO	6,482.41	24.35
2. Manufacturing Ind. and Constr.	3,506.30	0.30	6.26	0.04	8.37	NO	3,520.93	13.23
3. Transport	4,453.38	1.48	31.00	0.46	96.75	NO	4,581.14	17.21
4. Comm./Inst., Resid., Agricult.	3,549.17	4.01	84.19	0.10	20.99	NO	3,654.36	13.73
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	691.44	50.20	1,054.14	0.34	0.34	NO	1,745.91	6.56
1. Solid Fuels	NO	NO	4.29	NO	NO	NO	4.29	NO
2. Oil and Natural Gas	691.44	49.99	1,049.85	0.34	0.34	NO	1,741.62	6.54
2. Industrial Processes	**1,795.81**	**0.25**	**5.17**	**2.03**	**629.16**	**155.19**	**2,585.32**	**9.71**
A. Mineral products	1,275.21	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,275.21	4.79
B. Chemical Industry	492.14	5.17	5.17	2.03	629.16	NO	1,126.47	4.23
C. Metal Production	28.45	NE,NO	NE,NO	NO	NO	NO	28.45	0.11
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	155.19	155.19	0.58
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**71.49**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**106.21**	**0.40**
4. Agriculture	**NO**	**41.75**	**876.80**	**7.52**	**2,329.87**	**NO**	**3,206.66**	**12.05**
A. Enteric Fermentation	NO	33.82	710.19	0.00	0.00	NO	710.19	2.67
B. Manure Management	NO	7.93	166.61	0.72	222.78	NO	389.39	1.46
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	6.80	2,107.08	NO	2,107.08	7.92
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,556.41**	**0.07**	**1.39**	**0.01**	**3.65**	**NO**	**-8,551.37**	**-32.12**
A. Forest Land	-9,032.40	0.07	1.39	0.00	0.32	NO	-9,030.69	-33.92
B. Cropland	168.37	NE,NO	NE,NO	3.33	3.33	NO	171.70	NO
C. Grassland	-108.60	NE,NO	NE,NO	NE,NO	NE,NO	NO	-108.60	NO
D. Wetlands	43.91	NE,NO	NE,NO	NE,NO	NE,NO	NO	43.91	NO
E. Settlements	372.30	NE,NO	NE,NO	NE,NO	NE,NO	NO	372.30	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**31.07**	**652.37**	**0.28**	**85.38**	**NO**	**737.79**	**2.77**
A. Solid Waste Disposal on Land	NA,NO	18.18	381.84	0.00	0.00	NO	381.84	1.43
B. Waste Water Handling	0.00	12.88	270.53	0.28	85.38	NO	355.91	1.34
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**11,978.86**	**129.25**	**2,714.26**	**10.28**	**3,186.32**	**155.19**	**18,069.35**	**67.88**
Total Emissions without LULUCF	**20,535.28**	**129.18**	**2,714.26**	**10.28**	**3,186.32**	**155.19**	**26,620.72**	**100.0**
Share of Gasses in Total Emiss./Remov.	**66.29**		**15.02**		**17.63**		**100.00**	
Share of Gasses in Total Emissions	**77.14**		**10.20**		**11.97**		**100.00**	
Memo Items:								
International Bunkers	263.26	0.01	0.12	0.01	1.89	NO	265.28	
Aviation	197.59	0.00	0.03	0.01	1.73	NO	199.35	
Marine	65.68	0.00	0.09	0.00	0.16	NO	65.94	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,495.79	NO	NO	NO	NO	NO	1,495.79	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2000	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**18,085.98**	**59.33**	**1,246.02**	**0.48**	**150.31**	**NO**	**19,482.32**	**73.95**
A. Fuel Combustion	17,347.11	6.37	133.72	0.71	149.99	NO	17,630.83	66.93
1. Energy Industries	5,877.45	0.14	3.00	0.07	14.56	NO	5,895.01	22.38
2. Manufacturing Ind. and Constr.	3,616.74	0.30	6.40	0.04	8.72	NO	3,631.87	13.79
3. Transport	4,463.76	1.43	29.95	0.49	103.60	NO	4,597.31	17.45
4. Comm./Inst., Resid., Agricult.	3,389.15	4.49	94.38	0.11	23.11	NO	3,506.65	13.31
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	738.88	52.97	1,112.30	0.32	0.32	NO	1,851.49	7.03
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	738.88	52.97	1,112.30	0.32	0.32	NO	1,851.49	7.03
2. Industrial Processes	**1,932.72**	**0.25**	**5.23**	**2.39**	**740.39**	**182.86**	**2,861.20**	**10.86**
A. Mineral products	1,417.12	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,417.12	5.38
B. Chemical Industry	497.96	5.23	5.23	2.39	740.39	NO	1,243.58	4.72
C. Metal Production	17.64	NE,NO	NE,NO	NO	NO	NO	17.64	0.07
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	182.86	182.86	0.69
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**74.50**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**109.22**	**0.41**
4. Agriculture	**NO**	**40.65**	**853.60**	**7.34**	**2,276.56**	**NO**	**3,130.16**	**11.88**
A. Enteric Fermentation	NO	33.28	698.87	0.00	0.00	NO	698.87	2.65
B. Manure Management	NO	7.37	154.73	0.70	216.04	NO	370.76	1.41
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	6.65	2,060.53	NO	2,060.53	7.82
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-7,784.70**	**2.41**	**50.70**	**0.05**	**14.76**	**NO**	**-7,719.24**	**-29.30**
A. Forest Land	-8,334.12	2.41	50.70	0.04	11.60	NO	-8,271.82	-31.40
B. Cropland	245.45	NE,NO	NE,NO	3.16	3.16	NO	248.61	NO
C. Grassland	-125.55	NE,NO	NE,NO	NE,NO	NE,NO	NO	-125.55	NO
D. Wetlands	45.63	NE,NO	NE,NO	NE,NO	NE,NO	NO	45.63	NO
E. Settlements	383.89	NE,NO	NE,NO	NE,NO	NE,NO	NO	383.89	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**32.27**	**677.66**	**0.27**	**82.98**	**NO**	**760.67**	**2.89**
A. Solid Waste Disposal on Land	NA,NO	19.24	404.11	0.00	0.00	NO	404.11	1.53
B. Waste Water Handling	0.00	13.03	273.55	0.27	82.98	NO	356.53	1.35
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**12,308.54**	**134.91**	**2,833.20**	**10.53**	**3,265.01**	**182.86**	**18,624.33**	**70.70**
Total Emissions without LULUCF	**20,093.24**	**132.50**	**2,833.20**	**10.53**	**3,265.01**	**182.86**	**26,343.57**	**100.0**
Share of Gasses in Total Emiss./Remov.	**66.09**		**15.21**		**17.53**		**100.00**	
Share of Gasses in Total Emissions	**76.27**		**10.75**		**12.39**		**100.00**	
Memo Items:								
International Bunkers	226.42	0.00	0.10	0.01	1.62	NO	228.15	
Aviation	169.40	0.00	0.03	0.00	1.48	NO	170.91	
Marine	57.02	0.00	0.08	0.00	0.14	NO	57.24	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,680.11	NO	NO	NO	NO	NO	1,680.11	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2001	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**18,905.85**	**64.37**	**1,351.86**	**0.46**	**141.67**	**NO**	**20,399.39**	**74.18**
A. Fuel Combustion	18,117.29	5.19	108.99	0.67	141.37	NO	18,367.65	66.79
1. Energy Industries	6,376.36	0.16	3.42	0.07	15.23	NO	6,395.01	23.25
2. Manufacturing Ind. and Constr.	3,613.71	0.29	6.10	0.04	8.67	NO	3,628.47	13.19
3. Transport	4,521.54	1.22	25.71	0.47	98.17	NO	4,645.42	16.89
4. Comm./Inst., Resid., Agricult.	3,605.68	3.51	73.76	0.09	19.30	NO	3,698.74	13.45
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	788.56	59.18	1,242.88	0.31	0.31	NO	2,031.74	7.39
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	788.56	59.18	1,242.88	0.31	0.31	NO	2,031.74	7.39
2. Industrial Processes	**2,049.05**	**0.26**	**5.43**	**2.01**	**622.72**	**205.67**	**2,882.87**	**10.48**
A. Mineral products	1,636.05	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,636.05	5.95
B. Chemical Industry	403.70	5.43	5.43	2.01	622.72	NO	1,031.85	3.75
C. Metal Production	9.29	NE,NO	NE,NO	NO	NO	NO	9.29	0.03
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	205.67	205.67	0.75
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**79.04**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**113.76**	**0.41**
4. Agriculture	**NO**	**41.54**	**872.37**	**7.90**	**2,449.50**	**NO**	**3,321.87**	**12.08**
A. Enteric Fermentation	NO	34.13	716.79	0.00	0.00	NO	716.79	2.61
B. Manure Management	NO	7.41	155.59	0.70	218.27	NO	373.86	1.36
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.20	2,231.23	NO	2,231.23	8.11
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,188.47**	**0.49**	**10.37**	**0.02**	**6.06**	**NO**	**-8,172.03**	**-29.72**
A. Forest Land	-8,783.26	0.49	10.37	0.01	2.37	NO	-8,770.52	-31.89
B. Cropland	278.07	NE,NO	NE,NO	3.69	3.69	NO	281.75	NO
C. Grassland	-171.74	NE,NO	NE,NO	NE,NO	NE,NO	NO	-171.74	NO
D. Wetlands	36.33	NE,NO	NE,NO	NE,NO	NE,NO	NO	36.33	NO
E. Settlements	452.14	NE,NO	NE,NO	NE,NO	NE,NO	NO	452.14	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**32.98**	**692.54**	**0.29**	**89.30**	**NO**	**781.89**	**2.84**
A. Solid Waste Disposal on Land	NA,NO	20.47	429.83	0.00	0.00	NO	429.83	1.56
B. Waste Water Handling	0.00	12.51	262.72	0.29	89.30	NO	352.02	1.28
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**12,845.52**	**139.65**	**2,932.58**	**10.68**	**3,309.25**	**205.67**	**19,327.75**	**70.28**
Total Emissions without LULUCF	**21,033.98**	**139.15**	**2,932.58**	**10.68**	**3,309.25**	**205.67**	**27,499.78**	**100.0**
Share of Gasses in Total Emiss./Remov.	**66.46**		**15.17**		**17.12**		**100.00**	
Share of Gasses in Total Emissions	**76.49**		**10.66**		**12.03**		**100.00**	
Memo Items:								
International Bunkers	258.85	0.01	0.15	0.01	1.71	NO	260.70	
Aviation	169.48	0.00	0.03	0.00	1.48	NO	170.99	
Marine	89.37	0.01	0.13	0.00	0.22	NO	89.71	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,315.01	NO	NO	NO	NO	NO	1,315.01	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2002	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**20,000.80**	**66.85**	**1,403.88**	**0.33**	**102.91**	**NO**	**21,507.59**	**75.19**
A. Fuel Combustion	19,198.13	5.24	110.04	0.49	102.60	NO	19,410.77	67.86
1. Energy Industries	7,247.35	0.19	3.94	0.08	17.84	NO	7,269.12	25.41
2. Manufacturing Ind. and Constr.	3,436.58	0.28	5.86	0.04	8.51	NO	3,450.96	12.06
3. Transport	4,822.39	1.19	24.92	0.27	56.50	NO	4,903.81	17.14
4. Comm./Inst., Resid., Agricult.	3,691.81	3.59	75.33	0.09	19.75	NO	3,786.89	13.24
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	802.67	61.61	1,293.84	0.31	0.31	NO	2,096.82	7.33
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	802.67	61.61	1,293.84	0.31	0.31	NO	2,096.82	7.33
2. Industrial Processes	**2,003.28**	**0.21**	**4.49**	**1.95**	**604.48**	**237.70**	**2,849.94**	**9.96**
A. Mineral products	1,634.34	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,634.34	5.71
B. Chemical Industry	363.78	4.49	4.49	1.95	604.48	NO	972.75	3.40
C. Metal Production	5.16	NE,NO	NE,NO	NO	NO	NO	5.16	0.02
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	237.70	237.70	0.83
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**103.91**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**138.63**	**0.48**
4. Agriculture	**NO**	**41.25**	**866.16**	**7.83**	**2,426.07**	**NO**	**3,292.23**	**11.51**
A. Enteric Fermentation	NO	33.72	708.14	0.00	0.00	NO	708.14	2.48
B. Manure Management	NO	7.52	158.02	0.69	212.82	NO	370.84	1.30
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.14	2,213.25	NO	2,213.25	7.74
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,378.67**	**0.25**	**5.22**	**0.02**	**5.40**	**NO**	**-8,368.05**	**-29.26**
A. Forest Land	-8,968.17	0.25	5.22	0.00	1.19	NO	-8,961.76	-31.33
B. Cropland	254.40	NE,NO	NE,NO	4.21	4.21	NO	258.61	NO
C. Grassland	-158.65	NE,NO	NE,NO	NE,NO	NE,NO	NO	-158.65	NO
D. Wetlands	34.40	NE,NO	NE,NO	NE,NO	NE,NO	NO	34.40	NO
E. Settlements	459.36	NE,NO	NE,NO	NE,NO	NE,NO	NO	459.36	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**34.30**	**720.27**	**0.31**	**94.86**	**NO**	**815.18**	**2.85**
A. Solid Waste Disposal on Land	NA,NO	21.85	458.90	0.00	0.00	NO	458.90	1.60
B. Waste Water Handling	0.00	12.45	261.38	0.31	94.86	NO	356.24	1.25
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**13,729.35**	**142.86**	**3,000.02**	**10.43**	**3,233.73**	**237.70**	**20,235.52**	**70.74**
Total Emissions without LULUCF	**22,108.03**	**142.61**	**3,000.02**	**10.43**	**3,233.73**	**237.70**	**28,603.57**	**100.0**
Share of Gasses in Total Emiss./Remov.	**67.85**		**14.83**		**15.98**		**100.00**	
Share of Gasses in Total Emissions	**77.29**		**10.49**		**11.31**		**100.00**	
Memo Items:								
International Bunkers	236.22	0.01	0.13	0.01	1.61	NO	237.96	
Aviation	162.99	0.00	0.02	0.00	1.43	NO	164.44	
Marine	73.24	0.00	0.10	0.00	0.18	NO	73.52	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,331.36	NO	NO	NO	NO	NO	1,331.36	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2003	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**21,385.03**	**68.34**	**1,435.14**	**0.36**	**112.13**	**NO**	**22,932.30**	**76.42**
A. Fuel Combustion	20,630.90	6.23	130.85	0.53	111.84	NO	20,873.59	69.56
1. Energy Industries	7,924.83	0.22	4.55	0.09	19.72	NO	7,949.10	26.49
2. Manufacturing Ind. and Constr.	3,575.58	0.31	6.54	0.05	9.56	NO	3,591.68	11.97
3. Transport	5,210.40	1.14	23.91	0.28	58.69	NO	5,293.00	17.64
4. Comm./Inst., Resid., Agricult.	3,920.10	4.56	95.85	0.11	23.86	NO	4,039.81	13.46
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	754.13	62.11	1,304.29	0.29	0.29	NO	2,058.71	6.86
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	754.13	62.11	1,304.29	0.29	0.29	NO	2,058.71	6.86
2. Industrial Processes	**2,031.46**	**0.23**	**4.92**	**1.84**	**569.79**	**275.90**	**2,882.06**	**9.60**
A. Mineral products	1,613.56	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,613.56	5.38
B. Chemical Industry	409.38	4.92	4.92	1.84	569.79	NO	984.09	3.28
C. Metal Production	8.51	NE,NO	NE,NO	NO	NO	NO	8.51	0.03
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	275.90	275.90	0.92
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**112.13**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**146.85**	**0.49**
4. Agriculture	**NO**	**43.16**	**906.46**	**7.40**	**2,295.26**	**NO**	**3,201.72**	**10.67**
A. Enteric Fermentation	NO	35.28	740.85	0.00	0.00	NO	740.85	2.47
B. Manure Management	NO	7.89	165.62	0.72	222.75	NO	388.37	1.29
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	6.69	2,072.50	NO	2,072.50	6.91
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-7,969.18**	**1.16**	**24.42**	**0.03**	**10.32**	**NO**	**-7,934.44**	**-26.44**
A. Forest Land	-8,557.00	1.16	24.42	0.02	5.58	NO	-8,527.00	-28.42
B. Cropland	239.61	NE,NO	NE,NO	4.73	4.73	NO	244.34	NO
C. Grassland	-155.77	NE,NO	NE,NO	NE,NO	NE,NO	NO	-155.77	NO
D. Wetlands	32.46	NE,NO	NE,NO	NE,NO	NE,NO	NO	32.46	NO
E. Settlements	471.53	NE,NO	NE,NO	NE,NO	NE,NO	NO	471.53	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**35.70**	**749.78**	**0.31**	**95.62**	**NO**	**845.44**	**2.82**
A. Solid Waste Disposal on Land	NA,NO	23.39	491.15	0.00	0.00	NO	491.15	1.64
B. Waste Water Handling	0.00	12.32	258.63	0.31	95.62	NO	354.25	1.18
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**15,559.48**	**148.61**	**3,120.72**	**9.95**	**3,083.12**	**275.90**	**22,073.93**	**73.56**
Total Emissions without LULUCF	**23,528.66**	**147.44**	**3,120.72**	**9.95**	**3,083.12**	**275.90**	**30,008.37**	**100.0**
Share of Gasses in Total Emiss./Remov.	**70.49**		**14.14**		**13.97**		**100.00**	
Share of Gasses in Total Emissions	**78.41**		**10.40**		**10.27**		**100.00**	
Memo Items:								
International Bunkers	230.13	0.01	0.12	0.01	1.58	NO	231.83	
Aviation	161.46	0.00	0.02	0.00	1.41	NO	162.90	
Marine	68.67	0.00	0.10	0.00	0.17	NO	68.93	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,714.51	NO	NO	NO	NO	NO	1,714.51	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2004	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**20,777.85**	**69.50**	**1,459.55**	**0.53**	**162.78**	**NO**	**22,400.19**	**74.32**
A. Fuel Combustion	19,975.60	6.06	127.25	0.77	162.50	NO	20,265.35	67.24
1. Energy Industries	6,821.48	0.21	4.40	0.08	17.79	NO	6,843.66	22.71
2. Manufacturing Ind. and Constr.	3,976.89	0.36	7.55	0.05	11.36	NO	3,995.80	13.26
3. Transport	5,343.72	1.07	22.38	0.52	110.16	NO	5,476.25	18.17
4. Comm./Inst., Resid., Agricult.	3,833.52	4.42	92.92	0.11	23.20	NO	3,949.64	13.10
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	802.25	63.44	1,332.30	0.28	0.28	NO	2,134.84	7.08
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	802.25	63.44	1,332.30	0.28	0.28	NO	2,134.84	7.08
2. Industrial Processes	**2,233.70**	**0.22**	**4.68**	**2.24**	**695.34**	**313.28**	**3,247.00**	**10.77**
A. Mineral products	1,723.39	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,723.39	5.72
B. Chemical Industry	495.43	4.68	4.68	2.24	695.34	NO	1,195.45	3.97
C. Metal Production	14.89	NE,NO	NE,NO	NO	NO	NO	14.89	0.05
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	313.28	313.28	1.04
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**140.80**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**175.52**	**0.58**
4. Agriculture	**NO**	**45.20**	**949.30**	**8.03**	**2,488.94**	**NO**	**3,438.24**	**11.41**
A. Enteric Fermentation	NO	36.70	770.70	0.00	0.00	NO	770.70	2.56
B. Manure Management	NO	8.50	178.60	0.73	227.71	NO	406.31	1.35
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.29	2261.23	NO	2261.23	7.50
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,013.91**	**0.05**	**1.05**	**0.02**	**5.50**	**NO**	**-8,007.36**	**-26.57**
A. Forest Land	-8,654.74	0.05	1.05	0.00	0.24	NO	-8,653.45	-28.71
B. Cropland	249.08	NE,NO	NE,NO	5.26	5.26	NO	254.34	NO
C. Grassland	-173.86	NE,NO	NE,NO	NE,NO	NE,NO	NO	-173.86	NO
D. Wetlands	30.53	NE,NO	NE,NO	NE,NO	NE,NO	NO	30.53	NO
E. Settlements	535.08	NE,NO	NE,NO	NE,NO	NE,NO	NO	535.08	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**37.28**	**782.86**	**0.31**	**95.60**	**NO**	**878.50**	**2.91**
A. Solid Waste Disposal on Land	NA,NO	24.82	521.32	0.00	0.00	NO	521.32	1.73
B. Waste Water Handling	0.00	12.45	261.54	0.31	95.60	NO	357.14	1.18
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**15,138.48**	**152.26**	**3,197.44**	**11.12**	**3,448.15**	**313.28**	**22,132.08**	**73.43**
Total Emissions without LULUCF	**23,152.39**	**152.21**	**3197.44**	**11.12**	**3,448.15**	**313.28**	**30,139.44**	**100.0**
Share of Gasses in Total Emiss./Remov.	**68.40**		**14.45**		**15.58**		**100.00**	
Share of Gasses in Total Emissions	**76.82**		**10.61**		**11.44**		**100.00**	
Memo Items:								
International Bunkers	260.46	0.01	0.13	0.01	1.82	NO	262.41	
Aviation	187.39	0.00	0.03	0.01	1.64	NO	189.06	
Marine	73.06	0.00	0.10	0.00	0.18	NO	73.35	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,704.33	NO	NO	NO	NO	NO	1,704.33	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2005	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**21,060.77**	**69.14**	**1,451.96**	**0.51**	**159.65**	**NO**	**22,672.38**	**74.33**
A. Fuel Combustion	20,280.60	5.72	120.22	0.76	159.38	NO	20,560.20	67.40
1. Energy Industries	6,779.24	0.20	4.25	0.09	18.12	NO	6,801.61	22.30
2. Manufacturing Ind. and Constr.	4,081.03	0.33	6.92	0.05	10.39	NO	4,098.34	13.44
3. Transport	5,553.38	0.91	19.17	0.52	108.63	NO	5,681.18	18.62
4. Comm./Inst., Resid., Agricult.	3,866.95	4.28	89.88	0.11	22.24	NO	3,979.06	13.04
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	780.17	63.42	1,331.74	0.27	0.27	NO	2,112.18	6.92
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	780.17	63.42	1331.74	0.27	0.27	NO	2,112.18	6.92
2. Industrial Processes	**2,264.29**	**0.20**	**4.27**	**2.19**	**678.84**	**347.13**	**3,294.53**	**10.80**
A. Mineral products	1,768.40	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,768.40	5.80
B. Chemical Industry	484.65	4.27	4.27	2.19	678.84	NO	1,167.77	3.83
C. Metal Production	11.24	NE,NO	NE,NO	NO	NO	NO	11.24	0.04
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	347.13	347.13	1.14
G. Other	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
3. Solvent and Other Product Use	**160.07**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**194.79**	**0.64**
4. Agriculture	**NO**	**45.77**	**961.15**	**8.12**	**2,516.55**	**NO**	**3,477.70**	**11.40**
A. Enteric Fermentation	NO	38.36	805.58	0.00	0.00	NO	805.58	2.64
B. Manure Management	NO	7.41	155.57	0.72	224.02	NO	379.59	1.24
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.40	2,292.53	NO	2,292.53	7.52
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,158.60**	**0.05**	**1.12**	**0.02**	**6.04**	**NO**	**-8,151.44**	**-26.72**
A. Forest Land	-8,783.84	0.05	1.12	0.00	0.26	NO	-8,782.46	-28.79
B. Cropland	230.06	NE,NO	NE,NO	5.78	5.78	NO	235.84	NO
C. Grassland	-162.37	NE,NO	NE,NO	NE,NO	NE,NO	NO	-162.37	NO
D. Wetlands	28.59	NE,NO	NE,NO	NE,NO	NE,NO	NO	28.59	NO
E. Settlements	528.96	NE,NO	NE,NO	NE,NO	NE,NO	NO	528.96	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.03**	**36.39**	**764.20**	**0.32**	**99.83**	**NO**	**864.06**	**2.83**
A. Solid Waste Disposal on Land	NA,NO	24.01	504.14	0.00	0.00	NO	504.14	1.65
B. Waste Water Handling	0.00	12.38	260.05	0.32	99.83	NO	359.89	1.18
C. Waste Incineration	0.03	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.03	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**15,326.56**	**151.56**	**3,182.71**	**11.16**	**3,460.91**	**347.13**	**22,352.02**	**73.28**
Total Emissions without LULUCF	**23,485.16**	**151.50**	**3,182.71**	**11.16**	**3,460.91**	**347.13**	**30,503.46**	**100.0**
Share of Gasses in Total Emiss./Remov.	**68.57**		**14.24**		**15.48**		**100.00**	
Share of Gasses in Total Emissions	**76.99**		**10.43**		**11.35**		**100.00**	
Memo Items:								
International Bunkers	305.13	0.01	0.14	0.01	2.18	NO	307.45	
Aviation	226.15	0.00	0.03	0.01	1.98	NO	228.16	
Marine	78.98	0.01	0.11	0.00	0.19	NO	79.29	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,586.57	NO	NO	NO	NO	NO	1,586.57	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2006	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**21,137.23**	**75.86**	**1,593.02**	**0.37**	**115.15**	**NO**	**22,845.40**	**73.44**
A. Fuel Combustion	20,347.42	5.71	120.00	0.55	114.87	NO	20,582.29	66.17
1. Energy Industries	6,628.38	0.19	4.05	0.08	17.31	NO	6,649.74	21.38
2. Manufacturing Ind. and Constr.	4,181.48	0.34	7.10	0.05	11.07	NO	4,199.64	13.50
3. Transport	5,907.68	0.95	19.87	0.31	64.60	NO	5,992.14	19.26
4. Comm./Inst., Resid., Agricult.	3,629.88	4.24	88.99	0.10	21.90	NO	3,740.77	12.03
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	789.81	70.14	1,473.02	0.28	0.28	NO	2,263.11	7.28
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	789.81	70.14	1473.02	0.28	0.28	NO	2263.11	7.28
2. Industrial Processes	**2,389.75**	**0.29**	**6.07**	**2.17**	**671.21**	**379.09**	**3,446.11**	**11.08**
A. Mineral products	1,899.15	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,899.15	6.11
B. Chemical Industry	477.34	6.07	6.07	2.17	671.21	NO	1,154.62	3.71
C. Metal Production	13.25	NE,NO	NE,NO	NO	NO	NO	13.25	0.04
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	379.09	379.09	1.22
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**189.51**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**224.23**	**0.72**
4. Agriculture	**NO**	**49.52**	**1,040.01**	**8.43**	**2,614.60**	**NO**	**3,654.61**	**11.75**
A. Enteric Fermentation	NO	39.10	821.00	0.00	0.00	NO	821.00	2.64
B. Manure Management	NO	10.43	219.01	0.90	278.69	NO	497.70	1.60
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.54	2,335.91	NO	2,335.91	7.51
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,082.76**	**0.07**	**1.50**	**0.02**	**6.65**	**NO**	**-8,074.62**	**-25.96**
A. Forest Land	-8,681.14	0.07	1.50	0.00	0.34	NO	-8,679.30	-27.90
B. Cropland	208.00	NE,NO	NE,NO	6.30	6.30	NO	214.30	NO
C. Grassland	-166.34	NE,NO	NE,NO	NE,NO	NE,NO	NO	-166.34	NO
D. Wetlands	26.66	NE,NO	NE,NO	NE,NO	NE,NO	NO	26.66	NO
E. Settlements	530.06	NE,NO	NE,NO	NE,NO	NE,NO	NO	530.06	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.04**	**39.62**	**831.94**	**0.33**	**103.58**	**NO**	**935.56**	**3.01**
A. Solid Waste Disposal on Land	NA,NO	27.14	569.87	0.00	0.00	NO	569.87	1.83
B. Waste Water Handling	0.00	12.48	262.07	0.33	103.58	NO	365.65	1.18
C. Waste Incineration	0.04	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.04	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**15,633.76**	**165.36**	**3,472.53**	**11.33**	**3,511.18**	**379.09**	**23,031.29**	**74.04**
Total Emissions without LULUCF	**23,716.52**	**165.29**	**3,472.53**	**11.33**	**3,511.18**	**379.09**	**31,105.91**	**100.0**
Share of Gasses in Total Emiss./Remov.	**67.88**		**15.08**		**15.25**		**100.00**	
Share of Gasses in Total Emissions	**76.24**		**11.16**		**11.29**		**100.00**	
Memo Items:								
International Bunkers	290.81	0.01	0.12	0.01	2.16	NO	293.09	
Aviation	229.82	0.00	0.03	0.01	2.01	NO	231.87	
Marine	60.98	0.00	0.08	0.00	0.15	NO	61.22	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,641.97	NO	NO	NO	NO	NO	1,641.97	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2007	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**22,324.12**	**82.17**	**1,725.51**	**0.38**	**117.94**	**NO**	**24,167.57**	**74.02**
A. Fuel Combustion	21,573.18	5.08	106.58	0.56	117.66	NO	21,797.43	66.76
1. Energy Industries	7,737.05	0.22	4.69	0.09	18.94	NO	7,760.68	23.77
2. Manufacturing Ind. and Constr.	4,204.52	0.35	7.39	0.05	10.97	NO	4,222.89	12.93
3. Transport	6,330.19	0.91	19.09	0.33	68.95	NO	6,418.22	19.66
4. Comm./Inst., Resid., Agricult.	3,301.42	3.59	75.41	0.09	18.81	NO	3,395.64	10.40
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	750.94	77.09	1,618.92	0.27	0.27	NO	2,370.14	7.26
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	750.94	77.09	1,618.92	0.27	0.27	NO	2,370.14	7.26
2. Industrial Processes	**2,462.81**	**0.26**	**5.48**	**2.39**	**741.40**	**419.62**	**3,629.32**	**11.12**
A. Mineral products	1,928.88	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,928.88	5.91
B. Chemical Industry	521.51	5.48	5.48	2.39	741.40	NO	1,268.39	3.88
C. Metal Production	12.42	NE,NO	NE,NO	NO	NO	NO	12.42	0.04
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	419.62	419.62	1.29
G. Other	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
3. Solvent and Other Product Use	**212.10**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**246.82**	**0.76**
4. Agriculture	**NO**	**47.83**	**1,004.46**	**8.40**	**2,603.39**	**NO**	**3,607.85**	**11.05**
A. Enteric Fermentation	NO	38.00	798.02	0.00	0.00	NO	798.02	2.44
B. Manure Management	NO	9.83	206.44	0.88	271.67	NO	478.11	1.46
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.52	2331.72	NO	2,331.72	7.14
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-7,737.34**	**0.24**	**5.01**	**0.03**	**7.97**	**NO**	**-7,724.35**	**-23.66**
A. Forest Land	-8,269.28	0.24	5.01	0.00	1.15	NO	-8,263.12	-25.31
B. Cropland	132.82	NE,NO	NE,NO	6.83	6.83	NO	139.65	NO
C. Grassland	-162.02	NE,NO	NE,NO	NE,NO	NE,NO	NO	-162.02	NO
D. Wetlands	24.72	NE,NO	NE,NO	NE,NO	NE,NO	NO	24.72	NO
E. Settlements	536.42	NE,NO	NE,NO	NE,NO	NE,NO	NO	536.42	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.08**	**42.46**	**891.65**	**0.34**	**105.25**	**NO**	**996.98**	**3.05**
A. Solid Waste Disposal on Land	NA,NO	29.86	627.08	0.00	0.00	NO	627.08	1.92
B. Waste Water Handling	0.00	12.60	264.56	0.34	105.25	NO	369.81	1.13
C. Waste Incineration	0.08	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.08	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**17,261.78**	**172.96**	**3,632.10**	**11.54**	**3,575.95**	**419.62**	**24,924.18**	**76.34**
Total Emissions without LULUCF	**24,999.12**	**172.72**	**3,632.10**	**11.54**	**3,575.95**	**419.62**	**32,648.53**	**100.0**
Share of Gasses in Total Emiss./Remov.	**69.26**		**14.57**		**14.35**		**100.00**	
Share of Gasses in Total Emissions	**76.57**		**11.12**		**10.95**		**100.00**	
Memo Items:								
International Bunkers	312.94	0.01	0.21	0.01	3.30	NO	316.45	
Aviation	237.29	0.01	0.11	0.01	3.12	NO	240.51	
Marine	75.65	0.00	0.10	0.00	0.19	NO	75.94	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,442.73	NO	NO	NO	NO	NO	1,442.73	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2008	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**21,154.97**	**77.84**	**1,634.59**	**0.36**	**113.07**	**NO**	**22,902.63**	**73.00**
A. Fuel Combustion	20,496.00	5.09	106.93	0.54	112.82	NO	20,715.75	66.03
1. Energy Industries	6,705.03	0.19	3.90	0.08	17.36	NO	6,726.30	21.44
2. Manufacturing Ind. and Constr.	4,197.67	0.33	6.95	0.05	10.07	NO	4,214.68	13.43
3. Transport	6,178.13	0.84	17.66	0.31	66.02	NO	6,261.82	19.96
4. Comm./Inst., Resid., Agricult.	3,415.17	3.73	78.42	0.09	19.36	NO	3,512.95	11.20
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	658.97	72.75	1,527.65	0.26	0.26	NO	2,186.88	6.97
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	658.97	72.75	1,527.65	0.26	0.26	NO	2,186.88	6.97
2. Industrial Processes	**2,395.16**	**0.19**	**3.90**	**2.44**	**756.66**	**436.72**	**3,592.44**	**11.45**
A. Mineral products	1,841.26	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,841.26	5.87
B. Chemical Industry	530.39	3.90	3.90	2.44	756.66	NO	1,290.95	4.11
C. Metal Production	23.51	NE,NO	NE,NO	NO	NO	NO	23.51	0.07
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	436.72	436.72	1.39
G. Other	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
3. Solvent and Other Product Use	**204.59**	**NO**	**NO**	**0.11**	**34.72**	**NO**	**239.31**	**0.76**
4. Agriculture	**NO**	**48.62**	**1,021.11**	**8.26**	**2,560.38**	**NO**	**3,581.49**	**11.42**
A. Enteric Fermentation	NO	39.26	824.43	0.00	0.00	NO	824.43	2.63
B. Manure Management	NO	9.37	196.68	0.82	255.58	NO	452.26	1.44
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.43	2,304.80	NO	2,304.80	7.35
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-7,835.58**	**0.18**	**3.83**	**0.03**	**8.23**	**NO**	**-7,823.51**	**-24.94**
A. Forest Land	-8,371.98	0.18	3.83	0.00	0.88	NO	-8,367.27	-26.67
B. Cropland	98.94	NE,NO	NE,NO	7.35	7.35	NO	106.29	NO
C. Grassland	-164.52	NE,NO	NE,NO	NE,NO	NE,NO	NO	-164.52	NO
D. Wetlands	22.79	NE,NO	NE,NO	NE,NO	NE,NO	NO	22.79	NO
E. Settlements	579.19	NE,NO	NE,NO	NE,NO	NE,NO	NO	579.19	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**1.01**	**45.30**	**951.39**	**0.34**	**105.08**	**NO**	**1,057.48**	**3.37**
A. Solid Waste Disposal on Land	NA,NO	32.87	690.17	0.00	0.00	NO	690.17	2.20
B. Waste Water Handling	0.00	12.44	261.22	0.34	105.08	NO	366.30	1.17
C. Waste Incineration	1.01	NE,NO	NE,NO	NE,NO	NE,NO	NO	1.01	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**15,920.15**	**172.13**	**3,614.82**	**11.43**	**3,543.42**	**436.72**	**23,549.83**	**75.06**
Total Emissions without LULUCF	**23,755.72**	**171.95**	**3,614.82**	**11.43**	**3,543.42**	**436.72**	**31,373.34**	**100.0**
Share of Gasses in Total Emiss./Remov.	**67.60**		**15.35**		**15.05**		**100.00**	
Share of Gasses in Total Emissions	**75.72**		**11.52**		**11.29**		**100.00**	
Memo Items:								
International Bunkers	332.32	0.01	0.29	0.02	4.81	NO	337.42	
Aviation	265.52	0.01	0.20	0.02	4.65	NO	270.37	
Marine	66.80	0.00	0.09	0.00	0.16	NO	67.05	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,412.76	NO	NO	NO	NO	NO	1,412.76	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2009	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**19,956.68**	**75.37**	**1,582.87**	**0.36**	**111.13**	**NO**	**21,650.68**	**73.78**
A. Fuel Combustion	19,361.89	5.20	109.25	0.53	110.89	NO	19,582.04	66.73
1. Energy Industries	6,373.34	0.19	4.07	0.07	14.82	NO	6,392.23	21.78
2. Manufacturing Ind. and Constr.	3,378.56	0.30	6.20	0.04	8.83	NO	3,393.59	11.57
3. Transport	6,182.15	0.78	16.38	0.32	67.04	NO	6,265.58	21.35
4. Comm./Inst., Resid., Agricult.	3,427.84	3.93	82.59	0.10	20.21	NO	3,530.65	12.03
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	594.79	70.17	1,473.62	0.24	0.24	NO	2,068.64	7.05
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	594.79	70.17	1,473.62	0.24	0.24	NO	2,068.64	7.05
2. Industrial Processes	**1,906.09**	**0.04**	**0.92**	**2.04**	**632.25**	**444.27**	**2,983.54**	**10.17**
A. Mineral products	1,449.16	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,449.16	4.94
B. Chemical Industry	445.63	0.92	0.92	2.04	632.25	NO	1,078.80	3.68
C. Metal Production	11.30	NE,NO	NE,NO	NO	NO	NO	11.30	0.04
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	444.27	444.27	1.51
G. Other	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
3. Solvent and Other Product Use	**119.32**	**NO**	**NO**	**0.11**	**33.59**	**NO**	**152.91**	**0.52**
4. Agriculture	**NO**	**48.72**	**1,023.13**	**7.85**	**2,434.02**	**NO**	**3,457.15**	**11.78**
A. Enteric Fermentation	NO	38.81	815.09	0.00	0.00	NO	815.09	2.78
B. Manure Management	NO	9.91	208.04	0.82	255.01	NO	463.04	1.58
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.03	2,179.01	NO	2,179.01	7.43
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-8,075.86**	**0.09**	**1.91**	**0.03**	**8.31**	**NO**	**-8,065.64**	**-27.49**
A. Forest Land	-8602.65	0.09	1.91	0.00	0.44	NO	-8600.30	-29.31
B. Cropland	85.30	NE,NO	NE,NO	7.87	7.87	NO	93.18	NO
C. Grassland	-160.58	NE,NO	NE,NO	NE,NO	NE,NO	NO	-160.58	NO
D. Wetlands	20.86	NE,NO	NE,NO	NE,NO	NE,NO	NO	20.86	NO
E. Settlements	581.22	NE,NO	NE,NO	NE,NO	NE,NO	NO	581.22	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.38**	**47.23**	**991.93**	**0.34**	**106.47**	**NO**	**1,098.78**	**3.74**
A. Solid Waste Disposal on Land	NA,NO	35.57	746.97	0.00	0.00	NO	746.97	2.55
B. Waste Water Handling	0.00	11.66	244.96	0.34	106.47	NO	351.43	1.20
C. Waste Incineration	0.38	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.38	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**13,906.62**	**171.46**	**3,600.75**	**10.62**	**3,292.19**	**444.27**	**21,277.43**	**72.51**
Total Emissions without LULUCF	**21,982.48**	**171.37**	**3,600.75**	**10.62**	**3,292.19**	**444.27**	**29,343.07**	**100.0**
Share of Gasses in Total Emiss./Remov.	**65.36**		**16.92**		**15.47**		**100.00**	
Share of Gasses in Total Emissions	**74.92**		**12.27**		**11.22**		**100.00**	
Memo Items:								
International Bunkers	248.79	0.01	0.20	0.01	4.03	NO	253.02	
Aviation	227.17	0.01	0.17	0.01	3.98	NO	231.31	
Marine	21.62	0.00	0.03	0.00	0.05	NO	21.71	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,541.07	NO	NO	NO	NO	NO	1,541.07	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2010	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**19,251.98**	**78.46**	**1,647.57**	**0.35**	**109.59**	**NO**	**21,009.15**	**73.00**
A. Fuel Combustion	18,690.42	5.72	120.07	0.52	109.36	NO	18,919.85	65.74
1. Energy Industries	5,883.79	0.21	4.50	0.08	16.41	NO	5,904.69	20.52
2. Manufacturing Ind. and Constr.	3,363.53	0.32	6.71	0.04	9.12	NO	3,379.36	11.74
3. Transport	5,963.40	0.70	14.66	0.29	61.59	NO	6039.64	20.99
4. Comm./Inst., Resid., Agricult.	3,479.71	4.49	94.20	0.11	22.24	NO	3,596.16	12.50
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	561.56	72.74	1,527.50	0.23	0.23	NO	2,089.29	7.26
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	561.56	72.74	1,527.50	0.23	0.23	NO	2,089.29	7.26
2. Industrial Processes	**1,915.25**	**0.00**	**0.00**	**2.63**	**814.37**	**481.60**	**3,211.22**	**11.16**
A. Mineral products	1419.76	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,419.76	4.93
B. Chemical Industry	468.22	0.00	0.00	2.63	814.37	NO	1,282.59	4.46
C. Metal Production	27.27	NE,NO	NE,NO	NO	NO	NO	27.27	0.09
D. Other Production	NE	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	481.60	481.60	1.67
G. Other	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
3. Solvent and Other Product Use	**121.42**	**NO**	**NO**	**0.10**	**31.07**	**NO**	**152.48**	**0.53**
4. Agriculture	**NO**	**47.90**	**1,006.00**	**7.45**	**2,309.98**	**NO**	**3,315.98**	**11.52**
A. Enteric Fermentation	NO	38.48	808.18	0.00	0.00	NO	808.18	2.81
B. Manure Management	NO	9.42	197.82	0.78	240.27	NO	438.10	1.52
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	6.68	2,069.70	NO	2,069.70	7.19
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-7,881.67**	**0.06**	**1.32**	**0.03**	**8.70**	**NO**	**-7,871.65**	**-27.35**
A. Forest Land	-8,467.79	0.06	1.32	0.00	0.30	NO	-8,466.17	-29.42
B. Cropland	118.71	NE,NO	NE,NO	8.40	8.40	NO	127.10	NO
C. Grassland	-139.91	NE,NO	NE,NO	NE,NO	NE,NO	NO	-139.91	NO
D. Wetlands	18.92	NE,NO	NE,NO	NE,NO	NE,NO	NO	18.92	NO
E. Settlements	588.40	NE,NO	NE,NO	NE,NO	NE,NO	NO	588.40	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.13**	**46.92**	**985.39**	**0.34**	**106.29**	**NO**	**1,091.82**	**3.79**
A. Solid Waste Disposal on Land	NA,NO	35.21	739.50	0.00	0.00	NO	739.50	2.57
B. Waste Water Handling	0.00	11.71	245.90	0.34	106.29	NO	352.19	1.22
C. Waste Incineration	0.13	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.13	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**13,407.12**	**173.35**	**3,640.28**	**10.80**	**3,348.93**	**481.60**	**20,908.99**	**72.65**
Total Emissions without LULUCF	**21,288.79**	**173.28**	**3,640.28**	**10.80**	**3,348.93**	**481.60**	**28,780.65**	**100.0**
Share of Gasses in Total Emiss./Remov.	**64.12**		**17.41**		**16.02**		**100.00**	
Share of Gasses in Total Emissions	**73.97**		**12.65**		**11.64**		**100.00**	
Memo Items:								
International Bunkers	261.64	0.01	0.21	0.01	4.29	NO	266.14	
Aviation	242.21	0.01	0.18	0.01	4.24	NO	246.63	
Marine	19.43	0.00	0.03	0.00	0.05	NO	19.50	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	1,746.18	NO	NO	NO	NO	NO	1,746.18	

Croatia	CO_2	CH_4		N_2O		HFC,PFC,SF_6	Total	Share
Year 2011	**Gg**	**Gg**	**Gg CO_2eq**	**Gg**	**Gg CO_2eq**	**Gg CO_2eq**	**Gg CO_2eq**	**%**
1. Energy	**19,051.98**	**74.43**	**1,563.04**	**0.32**	**100.33**	**NO**	**20,715.35**	**72.89**
A. Fuel Combustion	18,474.82	6.45	135.55	0.48	100.12	NO	18,710.49	65.83
1. Energy Industries	6,252.91	0.22	4.62	0.09	17.91	NO	6,275.44	22.08
2. Manufacturing Ind. and Constr.	3,139.07	0.29	6.15	0.04	8.11	NO	3,153.34	11.09
3. Transport	5,826.11	0.66	13.94	0.23	48.65	NO	5,888.70	20.72
4. Comm./Inst., Resid., Agricult.	3,256.73	5.28	110.84	0.12	25.45	NO	3,393.01	11.94
5. Other	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Emissions from Fuels	577.16	67.98	1,427.49	0.21	0.21	NO	2,004.86	7.05
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	577.16	67.98	1,427.49	0.21	0.21	NO	2,004.86	7.05
2. Industrial Processes	**1,709.86**	**0.00**	**0.00**	**2.60**	**804.50**	**485.77**	**3,000.13**	**10.56**
A. Mineral products	1,204.74	NE,NO	NE,NO	NE,NO	NE,NO	NO	1,204.74	4.24
B. Chemical Industry	475.94	0.00	0.00	2.60	804.50	NO	1,280.44	4.51
C. Metal Production	29.18	NE,NO	NE,NO	NO	NO	NO	29.18	0.10
D. Other Production	0.00	NO	NO	NO	NO	NO	NE	NE
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6	NO	NO	NO	NO	NO	485.77	485.77	1.71
G. Other	NO	NO	NO	NO	NO	NO	NA,NO	NA,NO
3. Solvent and Other Product Use	**107.41**	**NO**	**NO**	**0.12**	**36.76**	**NO**	**144.16**	**0.51**
4. Agriculture	**NO**	**47.74**	**1,002.45**	**7.87**	**2,439.76**	**NO**	**3,442.21**	**12.11**
A. Enteric Fermentation	NO	38.28	803.80	0.00	0.00	NO	803.80	2.83
B. Manure Management	NO	9.46	198.65	0.78	241.58	NO	440.23	1.55
C. Rice Cultivation	NO	NO	NO	0.00	0.00	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	7.09	2,198.18	NO	2,198.18	7.73
E. Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land Use Change and Forestry	**-7,049.26**	**0.32**	**6.82**	**0.03**	**10.65**	**NO**	**-7,031.80**	**-24.74**
A. Forest Land	-7,637.48	0.32	6.82	0.01	1.56	NO	-7,629.10	-26.84
B. Cropland	93.99	NE,NO	NE,NO	9.09	9.09	NO	103.08	NO
C. Grassland	-125.67	NE,NO	NE,NO	NE,NO	NE,NO	NO	-125.67	NO
D. Wetlands	17.32	NE,NO	NE,NO	NE,NO	NE,NO	NO	17.32	NO
E. Settlements	602.58	NE,NO	NE,NO	NE,NO	NE,NO	NO	602.58	NO
F. Other Land	NO	NE,NO	NE,NO	NE,NO	NE,NO	NO	NE,NO	NO
G. Other	NE	NE	NE	NE	NE	NO	NE	NE
6. Waste	**0.05**	**48.37**	**1,015.81**	**0.33**	**103.76**	**NO**	**1,119.62**	**3.94**
A. Solid Waste Disposal on Land	NA,NO	36.71	770.89	0.00	0.00	NO	770.89	2.71
B. Waste Water Handling	0.00	11.66	244.92	0.33	103.76	NO	348.68	1.23
C. Waste Incineration	0.05	NE,NO	NE,NO	NE,NO	NE,NO	NO	0.05	0.00
D. Other	NO	NO	NO	NO	NO	NO	NO	NO
Total Emiss./Remov. with LULUCF	**13,820.03**	**170.86**	**3,588.11**	**11.16**	**3,459.01**	**485.77**	**21,389.67**	**75.26**
Total Emissions without LULUCF	**20,869.29**	**170.54**	**3,588.11**	**11.16**	**3,459.01**	**485.77**	**28,421.47**	**100.0**
Share of Gasses in Total Emiss./Remov.	**64.61**		**16.77**		**16.17**		**100.00**	
Share of Gasses in Total Emissions	**73.43**		**12.62**		**12.17**		**100.00**	
Memo Items:								
International Bunkers	327.56	0.01	0.29	0.01	4.60	NO	332.45	
Aviation	252.38	0.01	0.19	0.01	4.42	NO	256.98	
Marine	75.18	0.00	0.10	0.00	0.18	NO	75.47	
Multilateral Operations	C	C	C	C	C	NO	C	
CO_2 Emissions from Biomass	2,004.31	NO	NO	NO	NO	NO	2,004.31	

ANNEX II. SUMMARY OF REPORTING SUPPLEMENTARY INFORMATION UNDER ARTICLE 7, PARAGRAPH 2 OF THE KYOTO PROTOCOL

Information reported under Article 7, paragraph 2	Chapter in 6NC
National systems in accordance with Article 5, paragraph 1	3.3.
Nacional registries	3.4.
Supplementarity relating to the Mechanisms pursuant to Articles 6, 12, 17	5.6.
Policies and measures in accordance with Article 2	4.2.
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	4.1.
Information under Article 10: Article 10.a Article 10.b Article 10.c Article 10.d Article 10.e	 3.3. 4.1., 4.2. 7.2. 8. 9.
Financial resources	Not applicable for Republic of Croatia

ANNEX III. FIRST BIENNIAL REPORT OF THE REPUBLIC OF CROATIA ACCORDING TO DECISION 2/CP.17

III.1. INTRODUCTION

This First Biennial Report of the Republic of Croatia was prepared according to Decision 2/CP.17. For preparation of first biennial report (BR), UNFCCC reporting guidelines was used. According to Decision 19/CP.18 for reporting and submitting BR tables of the common tabular format (CTF), electronic reporting application was used. The CTF consists of 27 tables designed to facilitate the provision of information on:

1. Greenhouse gas (GHG) emission trends (table 1)
2. Description of quantified economy-wide emission reduction target (tables 2a-f)
3. Progress in achievement of this target (tables 3,4a-b)
4. GHG projections (5,6a-c)
5. Provision of financial, technological and capacity building support (tables 7a-b, 8 and 9)

In regard to greenhouse gas (GHG) emissions, this Report covers the period from 1990-2011. Emission projections are based on conditions and projections of macroeconomic parameters from 2010.

III.2. INFORMATION ON GHG EMISSIONS AND TRENDS

This Biennial Report presents the inventory of greenhouse gas emissions and removals in the Republic of Croatia in the period from 1990 to 2011. The inventory includes direct greenhouse gases: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydro fluorocarbons (HFCs, PFCs) and sulphur hexafluoride (SF6).

Total greenhouse gas emissions in the 2011, excluding LULUCF, amounts to 28,421 Gg CO2 eq, which represents a reduction of emissions by 10.3% in relation to greenhouse gas emissions in the 1990s.During the entire period from 1990 to 2011 shares of GHG emissions are not significantly changed. Contributions of individual greenhouse gases to the total 2011 emission were as follows: 73.9% CO2, 12.4% CH4, N2O 12.0%, 1.7% HFCs and PFCs and SF6 0.05%.

The largest contribution to the greenhouse gas emission in 2011 has the Energy Sector with share of 73,3%. In the year 2011, the greenhouse gas emission from Energy sector was 1.4 percent lower in relation to 2010. The total energy consumption in 2011 was 0.4 percent lower than in the previous year.

Industrial Processes contributes to total GHG emission with 10.6% in 2011. Due to decreasing of economic activity after 2008, which influenced decreasing of cement, lime and ammonia production, in 2011 emissions from this sector have dropped by 16 percent, regarding 2008.

Solvent and Other Product Use contributes to total GHG emission with 0.5% of the total national GHG emissions (presented as equivalent emission of CO2) in 2011. The GHG emission in 2011 was 23 percent larger than emission in 1990 since new activity data, regarding Other use of solvent, were included in the emission calculation.

Agriculture contributes to total GHG emission with 11.7% of the total national GHG emissions in 2011. The GHG emissions from Agriculture have been decreasing from 2006. The GHG emission in 2011 was about 24.1 percent lower in comparison with 1990 emission. According to estimation of Croatian experts for agriculture, approximately 11.5 percent of total GHG emissions belong to Agriculture.

Waste sector contributes to total GHG emission with 3.8% of the total national GHG emissions in 2011.Emissions from Waste sector have been constantly increasing in the period 1990-2011. Increasing emissions are a consequence of greater quantities of waste, activities in wastewater handling and waste incineration. The GHG emission in 2011 was 91 percent larger in comparison with 1990 emission.

Summary information on Croatia's national inventory, national system and register, are detailed in Chapter 3 of Croatia's 6th National communications (NC6).

For more information see Chapter b3 of NC6 and Common Tabular Format (CTF) Table 1.

CTF Table 1 Greenhouse Gas emissions (kt CO_2 eq)

GREENHOUSE GAS EMISSIONS	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	kt CO_2 eq										
CO_2 emissions including net CO_2 from LULUCF	18,895.52	17,686.10	11,754.76	10,780.38	11,596.59	10,778.74	11,146.05	11,772.26	11,271.01	12,136.94	12,908.60
CO_2 emissions excluding net CO_2 from LULUCF	23,080.45	23,338.72	17,352.45	16,708.08	17,165.18	16,490.29	17,201.66	17,834.25	18,861.38	19,623.64	20,526.13
CH_4 emissions including CH_4 from LULUCF	3,425.89	3,432.71	3,180.73	2,864.53	3,008.08	2,788.12	2,745.81	2,742.09	2,821.30	2,676.90	2,665.42
CH_4 emissions excluding CH_4 from LULUCF	3,425.87	3,420.21	3,168.23	2,861.68	2,983.88	2,777.13	2,743.94	2,734.56	2,809.42	2,654.60	2,664.02
N_2O emissions including N_2O from LULUCF	3,867.89	3,948.40	3,764.22	3,660.00	3,135.66	3,197.05	3,058.46	3,058.48	3,351.41	2,891.47	3,221.01
N_2O emissions excluding N_2O from LULUCF	3,867.89	3,940.75	3,756.74	3,654.89	3,125.84	3,190.41	3,054.07	3,052.97	3,345.06	2,882.91	3,217.39
HFCs	NO	NO	NO	NO	NO	NO	49.37	68.32	90.87	118.19	142.62
PFCs	936.56	936.56	642.44	NO	NO	NO	NO	NO	NO	NO	NO
SF_6	11.01	10.95	10.83	10.92	11.04	11.16	11.66	12.13	11.98	12.57	12.57
Total (including LULUCF)	27,136.87	26,014.72	19,352.99	17,315.82	17,751.36	16,775.06	17,011.35	17,653.28	17,546.57	17,836.07	18,950.21
Total (excluding LULUCF)	31,321.79	31,647.20	24,930.70	23,235.57	23,285.93	22,468.98	23,060.70	23,702.23	25,118.71	25,291.91	26,562.74
GREENHOUSE GAS SOURCE AND SINK CATEGORIES											
	kt CO_2 eq										
1. Energy	22,148.99	22,796.49	17,102.52	16,385.56	17,291.17	16,311.69	17,263.04	17,823.34	18,754.80	19,407.22	19,984.74
2. Industrial Processes	4,185.46	3,788.53	2,913.62	2,544.99	2,001.25	2,228.29	2,015.86	2,089.36	2,325.44	2,104.88	2,576.17
3. Solvent and Other Product Use	80.21	116.98	120.40	101.58	108.74	110.52	108.34	122.22	113.24	111.59	106.21
4. Agriculture	4,328.40	4,380.72	4,225.93	3,626.30	3,298.47	3,219.12	3,054.84	3,038.12	3,278.66	3,005.73	3,206.66
5. Land Use, Land-Use Change and Forestry[5]	-4,184.92	-5,632.48	-5,577.70	-5,919.74	-5,534.57	-5,693.92	-6,049.35	-6,048.95	-7,572.14	-7,455.84	-7,612.53
6. Waste	578.72	564.49	568.23	577.14	586.32	599.36	618.62	629.19	646.57	662.49	688.95
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)[5]	27,136.87	26,014.72	19,352.99	17,315.82	17,751.36	16,775.06	17,011.35	17,653.28	17,546.57	17,836.07	18,950.21

CTF Table 1 Greenhouse Gas emissions (kt CO_2 eq), cont.

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CO_2 emissions including net CO_2 from LULUCF	13,121.93	13,761.66	14,831.99	16,464.48	16,085.71	16,378.79	16,720.40	19,353.98	18,273.24	16,436.47
CO_2 emissions excluding net CO_2 from LULUCF	20,088.78	21,026.01	22,096.97	23,520.63	23,139.67	23,472.18	23,702.19	24,985.11	23,743.03	21,972.26
CH_4 emissions including CH_4 from LULUCF	2,779.85	2,887.61	2,954.01	3,075.17	3,147.82	3,133.04	3,380.39	3,536.13	3,521.86	3,523.69
CH_4 emissions excluding CH_4 from LULUCF	2,729.15	2,877.24	2,948.79	3,050.76	3,146.77	3,131.92	3,378.90	3,531.11	3,518.03	3,521.78
N_2O emissions including N_2O from LULUCF	3,299.69	3,343.94	3,268.40	3,117.79	3,489.62	3,495.58	3,427.92	3,647.08	3,516.84	3,269.82
N_2O emissions excluding N_2O from LULUCF	3,284.97	3,337.92	3,263.04	3,107.52	3,484.17	3,489.60	3,421.33	3,639.18	3,508.68	3,261.58
HFCs	170.68	193.42	225.11	263.03	300.11	333.47	365.45	405.94	424.16	435.68
PFCs	NO	NO	NO	NO	NO	NA,NO	NA,NO	NA,NO	NA,NO	0.20
SF_6	12.18	12.26	12.59	12.87	13.17	13.66	13.64	13.68	12.55	8.39
Total (including LULUCF)	19,384.34	20,198.88	21,292.10	22,933.34	23,036.43	23,354.54	23,907.80	26,956.81	25,748.65	23,674.26
Total (excluding LULUCF)	26,285.76	27,446.84	28,546.50	29,954.80	30,083.90	30,440.82	30,881.50	32,575.02	31,206.46	29,199.91
GREENHOUSE GAS SOURCE AND SINK CATEGORIES										
1. Energy	19,482.32	20,399.39	21,507.59	22,932.30	22,400.19	22,672.38	22,845.40	24,167.57	22,902.63	21,650.68
2. Industrial Processes	2,856.73	2,874.90	2,838.88	2,874.03	3,234.28	3,281.55	3,431.78	3,615.31	3,579.75	2,973.32
3. Solvent and Other Product Use	109.22	113.76	138.63	146.85	175.52	194.79	224.23	246.82	239.31	152.91
4. Agriculture	3,130.16	3,321.87	3,292.23	3,201.72	3,445.04	3,477.70	3,497.55	3,604.76	3,483.31	3,365.58
5. Land Use, Land-Use Change and Forestry[5]	-6,901.42	-7,247.95	-7,254.40	-7,021.46	-7,047.47	-7,086.28	-6,973.70	-5,618.21	-5,457.81	-5,525.65
6. Waste	707.33	736.91	769.17	799.89	828.88	814.40	882.55	940.57	1,001.46	1,057.41
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)[5]	19,384.34	20,198.88	21,292.10	22,933.34	23,036.43	23,354.54	23,907.80	26,956.81	25,748.65	23,674.26

CTF Table 1 Greenhouse Gas emissions (kt CO_2 eq), cont.

GREENHOUSE GAS EMISSIONS	2010	2011	Change from base to latest reported year
	kt CO_2 eq		
CO_2 emissions including net CO_2 from LULUCF	15,817.33	15,408.48	-12.88
CO_2 emissions excluding net CO_2 from LULUCF	21,312.42	20,891.56	-10.49
CH_4 emissions including CH_4 from LULUCF	3,567.32	3,515.92	2.42
CH_4 emissions excluding CH_4 from LULUCF	3,566.01	3,509.10	2.60
N_2O emissions including N_2O from LULUCF	3,359.80	3,399.92	-13.89
N_2O emissions excluding N_2O from LULUCF	3,351.18	3,392.30	-13.92
HFCs	472.25	475.94	100.00
PFCs	0.03	0.01	-100.00
SF_6	9.18	9.58	-12.55
Total (including LULUCF)	23,225.91	22,809.85	-12.32
Total (excluding LULUCF)	28,711.06	28,278.50	-10.64
GREENHOUSE GAS SOURCE AND SINK CATEGORIES			
	kt CO_2 eq		
1. Energy	21,009.15	20,715.35	-9.13
2. Industrial Processes	3,234.71	3,022.16	-20.23
3. Solvent and Other Product Use	152.48	139.21	19.01
4. Agriculture	3,265.21	3,323.49	-24.13
5. Land Use, Land-Use Change and Forestry[5]	-5,485.16	-5,468.65	-2.91
6. Waste	1,049.51	1,078.28	91.02
7. Other	NO	NO	0.00
Total (including LULUCF)[5]	23,225.91	22,809.85	-12.32

CTF Table 1 Emission trends (CO_2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	$ktCO_2$										
1. Energy	20,582.79	21,233.57	15,721.99	15,038.48	15,805.86	14,958.57	15,903.85	16,418.24	17,274.25	18,111.63	18,667.94
A. Fuel Comb. (SA)	20,166.84	20,593.76	15,103.18	14,413.03	14,981.26	14,218.65	15,034.38	15,574.95	16,478.78	17,403.51	17,976.50
1. Energy Ind.	7,126.54	7,126.54	4,768.18	5,338.81	5,918.93	4,671.23	5,262.45	5,110.49	5,593.57	6,272.23	6,467.65
2. Manuf. Ind. and Cons.	5,447.30	5,842.92	4,344.22	3,680.56	3,515.57	3,700.16	3,540.91	3,507.98	3,594.79	3,770.72	3,506.30
3. Transport	3,987.25	4,018.54	2,954.92	2,844.51	3,015.56	3,231.46	3,405.46	3,727.43	4,010.17	4,219.35	4,453.38
4. Other Sectors	3,605.76	3,605.76	3,035.86	2,549.15	2,531.21	2,615.80	2,825.55	3,229.05	3,280.24	3,141.20	3,549.17
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Em. from Fuels	415.95	639.82	618.81	625.45	824.60	739.92	869.47	843.29	795.48	708.12	691.44
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	415.95	639.82	618.81	625.45	824.60	739.92	869.47	843.29	795.48	708.12	691.44
2. Industrial Processes	2,417.36	2,022.85	1,544.74	1,602.70	1,285.25	1,455.87	1,224.15	1,328.47	1,508.56	1,435.11	1,786.66
A. Mineral Products	1,315.38	1,305.19	864.23	932.50	799.69	968.67	749.26	833.60	943.13	1,017.32	1,266.07
B. Chemical Industry	870.99	466.01	447.00	575.22	446.83	450.03	438.77	476.59	517.83	388.43	492.14
C. Metal Production	230.99	251.65	233.51	94.99	38.74	37.17	36.12	18.28	47.61	29.36	28.45
D. Other Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prod. of Haloc. and SF_6											
F. Con. of Haloc. and SF_6											
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Ot. Prod. Use	80.21	82.26	85.68	66.86	74.02	75.80	73.62	87.50	78.52	76.87	71.49
4. Agriculture											
A. Enteric Fermentation											
B. Manure Management											
C. Rice Cultivation											
D. Agricultural Soils											
E. Presc. Bur. of Savannas											
F. Field Bur. of Agr.Resid.											
G. Other											

CTF Table 1 Emission trends (CO_2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	$ktCO_2$										
5. LULUCF	-4,184.93	-5,652.62	-5,597.69	-5,927.70	-5,568.59	-5,711.55	-6,055.61	-6,062.00	-7,590.37	-7,486.70	-7,617.53
A. Forest Land	-4,184.93	-6,561.18	-6,394.38	-6,503.10	-6,302.86	-6,487.00	-6,605.97	-6,602.31	-8,147.89	-8,065.31	-8,217.68
B. Cropland	NE,NO	159.96	146.68	137.49	140.48	143.34	162.63	157.28	160.35	178.77	168.37
C. Grassland	NE,NO	-85.19	-56.59	-47.84	-60.10	-57.91	-80.97	-94.19	-89.27	-103.01	-108.60
D. Wetlands	NE,NO	30.00	30.17	31.89	33.60	35.32	37.04	38.76	40.47	42.19	43.91
E. Settlements	NE,NO	803.79	676.43	453.86	620.29	654.70	431.67	438.47	445.96	460.66	496.47
F. Other Land	NE,NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	0.09	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
A. Solid W. Disp.on Land	NE,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Waste-water Handling											
C. Waste Incineration	0.09	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CO2 emissions including net CO2 from LULUCF	18,895.52	17,686.10	11,754.76	10,780.38	11,596.59	10,778.74	11,146.05	11,772.26	11,271.01	12,136.94	12,908.60
Total CO2 emissions excluding net CO2 from LULUCF	23,080.45	23,338.72	17,352.45	16,708.08	17,165.18	16,490.29	17,201.66	17,834.25	18,861.38	19,623.64	20,526.13
Memo Items:											
International Bunkers	451.83	451.83	139.53	137.25	253.72	326.50	288.76	290.93	263.80	287.83	263.26
Aviation	343.29	343.29	68.19	56.62	139.18	188.18	186.75	176.02	190.17	206.83	197.59
Marine	108.54	108.54	71.34	80.62	114.54	138.33	102.01	114.91	73.63	81.00	65.68
Multilateral Operations	C	C	C	C	C	C	C	C	C	C	C
CO2 Emissions from Biomass	2,436.76	2,436.76	1,680.37	1,459.04	1,388.13	1,403.18	1,452.60	1,734.09	1,793.72	1,678.97	1,495.79

CTF Table 1 Emission trends (CO_2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	$ktCO_2$									
1. Energy	18,085.98	18,905.85	20,000.80	21,385.03	20,777.85	21,060.77	21,137.23	22,324.12	21,154.97	19,956.68
A. Fuel Comb. (SA)	17,347.11	18,117.29	19,198.13	20,630.90	19,975.60	20,280.60	20,347.42	21,573.18	20,496.00	19,361.89
1. Energy Ind.	5,877.45	6,376.36	7,247.35	7,924.83	6,821.48	6,779.24	6,628.38	7,737.05	6,705.03	6,373.34
2. Manuf. Ind. and Cons.	3,616.74	3,613.71	3,436.58	3,575.58	3,976.89	4,081.03	4,181.48	4,204.52	4,197.67	3,378.56
3. Transport	4,463.76	4,521.54	4,822.39	5,210.40	5,343.72	5,553.38	5,907.68	6,330.19	6,178.13	6,182.15
4. Other Sectors	3,389.15	3,605.68	3,691.81	3,920.10	3,833.52	3,866.95	3,629.88	3,301.42	3,415.17	3,427.84
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Em. from Fuels	738.88	788.56	802.67	754.13	802.25	780.17	789.81	750.94	658.97	594.79
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	738.88	788.56	802.67	754.13	802.25	780.17	789.81	750.94	658.97	594.79
2. Industrial Processes	1,928.25	2,041.08	1,992.22	2,023.43	2,220.98	2,251.31	2,375.41	2,448.81	2,382.47	1,895.88
A. Mineral Products	1,412.66	1,628.08	1,623.29	1,605.53	1,710.66	1,755.42	1,884.81	1,914.88	1,828.57	1,439.38
B. Chemical Industry	497.96	403.70	363.78	409.38	495.43	484.65	477.34	521.51	530.39	445.19
C. Metal Production	17.64	9.29	5.16	8.51	14.89	11.24	13.25	12.42	23.51	11.30
D. Other Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prod. of Haloc. and SF_6										
F. Con. of Haloc. and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Ot. Prod. Use	74.50	79.04	103.91	112.13	140.80	160.07	189.51	212.10	204.59	119.32
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Presc. Bur. of Savannas										
F. Field Bur. of Agr.Resid.										
G. Other										

CTF Table 1 Emission trends (CO_2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	$ktCO_2$									
5. LULUCF	-6,966.84	-7,264.35	-7,264.98	-7,056.15	-7,053.96	-7,093.39	-6,981.78	-5,631.13	-5,469.80	-5,535.79
A. Forest Land	-7,677.54	-8,040.29	-8,025.93	-7,794.91	-7,999.27	-7,937.18	-7,770.13	-6,305.26	-6,242.45	-6,256.20
B. Cropland	245.45	278.07	254.40	239.61	249.08	230.06	208.00	132.82	98.94	85.30
C. Grassland	-125.55	-171.74	-158.65	-155.77	-173.86	-162.37	-166.34	-162.02	-164.52	-160.58
D. Wetlands	45.63	36.33	34.40	32.46	30.53	28.59	26.66	24.72	22.79	20.86
E. Settlements	545.17	633.29	630.81	622.47	839.56	747.51	720.03	678.60	815.44	774.83
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.08	1.01	0.38
A. Solid W. Disp.on Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Waste-water Handling										
C. Waste Incineration	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.08	1.01	0.38
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CO2 emissions including net CO2 from LULUCF	13,121.93	13,761.66	14,831.99	16,464.48	16,085.71	16,378.79	16,720.40	19,353.98	18,273.24	16,436.47
Total CO2 emissions excluding net CO2 from LULUCF	20,088.78	21,026.01	22,096.97	23,520.63	23,139.67	23,472.18	23,702.19	24,985.11	23,743.03	21,972.26
Memo Items:										
International Bunkers	226.42	258.85	236.22	230.13	260.46	305.13	290.81	312.94	332.32	248.79
Aviation	169.40	169.48	162.99	161.46	187.39	226.15	229.82	237.29	265.52	227.17
Marine	57.02	89.37	73.24	68.67	73.06	78.98	60.98	75.65	66.80	21.62
Multilateral Operations	C	C	C	C	C	C	C	C	C	C
CO2 Emissions from Biomass	1,680.11	1,315.01	1,331.36	1,714.51	1,704.33	1,586.57	1,641.97	1,442.73	1,412.76	1,541.07

CTF Table 1 Emission trends (CO_2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	$ktCO_2$		
1. Energy	19,251.98	19,051.98	-10.27
A. Fuel Comb. (SA)	18,690.42	18,474.82	-10.29
1. Energy Ind.	5,883.79	6,252.91	-12.26
2. Manuf. Ind. and Cons.	3,363.53	3,139.07	-46.28
3. Transport	5,963.40	5,826.11	44.98
4. Other Sectors	3,479.71	3,256.73	-9.68
5. Other	NO	NO	0.00
B. Fugitive Em. from Fuels	561.56	577.16	-9.79
1. Solid Fuels	NO	NO	0.00
2. Oil and Natural Gas	561.56	577.16	-9.79
2. Industrial Processes	1,938.88	1,732.13	-14.37
A. Mineral Products	1,410.28	1,191.52	-8.71
B. Chemical Industry	501.33	511.43	9.75
C. Metal Production	27.27	29.18	-88.41
D. Other Production	NE	NE	0.00
E. Prod. of Haloc. and SF_6			
F. Con. of Haloc. and SF_6			
G. Other	NO	NO	0.00
3. Solvent and Ot. Prod. Use	121.42	107.41	30.58
4. Agriculture			
A. Enteric Fermentation			
B. Manure Management			
C. Rice Cultivation			
D. Agricultural Soils			
E. Presc. Bur. of Savannas			
F. Field Bur. of Agr.Resid.			
G. Other			

CTF Table 1 Emission trends (CO_2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	kt CO_2		
5. LULUCF	-5,495.09	-5,483.09	-3.00
A. Forest Land	-6,255.32	-6,218.39	-5.22
B. Cropland	118.71	93.99	-41.24
C. Grassland	-139.91	-125.67	47.53
D. Wetlands	18.92	17.32	-42.24
E. Settlements	762.52	749.66	-6.73
F. Other Land	NO	NO	0.00
G. Other	NE	NE	0.00
6. Waste	0.13	0.05	11.12
A. Solid W. Disp.on Land	NA,NO	NA,NO	0.00
B. Waste-water Handling			
C. Waste Incineration	0.13	0.05	11.12
D. Other	NO	NO	0.00
7. Other	NO	NO	0.00
Total CO2 emissions including net CO2 from LULUCF	15,817.33	15,408.48	-12.88
Total CO2 emissions excluding net CO2 from LULUCF	21,312.42	20,891.56	-10.49
Memo Items:			
International Bunkers	261.64	327.56	-27.51
Aviation	242.21	252.38	-26.48
Marine	19.43	75.18	-30.74
Multilateral Operations	C	C	0.00
CO2 Emissions from Biomass	1,746.18	2,004.31	-17.75

CTF Table 1 Emission trends (CH_4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	kt CH_4										
1. Energy	69.13	69.31	62.20	60.97	67.16	60.80	61.26	61.92	64.99	57.29	56.12
A. Fuel Comb. (SA)	9.61	9.74	6.42	5.26	4.99	5.25	5.41	6.32	6.38	6.16	5.92
1. Energy Ind.	0.17	0.17	0.11	0.11	0.14	0.12	0.14	0.13	0.12	0.14	0.14
2. Manuf. Ind. and Cons.	0.48	0.52	0.41	0.35	0.34	0.33	0.32	0.31	0.34	0.34	0.30
3. Transport	1.55	1.64	1.24	1.10	1.09	1.18	1.23	1.33	1.41	1.45	1.48
4. Other Sectors	7.40	7.40	4.66	3.69	3.43	3.62	3.71	4.54	4.51	4.24	4.01
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Em. from Fuels	59.52	59.57	55.78	55.71	62.17	55.55	55.85	55.60	58.61	51.13	50.20
1. Solid Fuels	2.32	2.32	2.07	1.61	1.54	1.38	1.10	0.89	0.65	0.68	0.20
2. Oil and Natural Gas	57.20	57.25	53.71	54.10	60.63	54.17	54.75	54.71	57.96	50.45	49.99
2. Industrial Processes	0.78	0.68	0.45	0.39	0.43	0.41	0.33	0.31	0.28	0.28	0.25
A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Chemical Industry	0.78	0.68	0.45	0.39	0.43	0.41	0.33	0.31	0.28	0.28	0.25
C. Metal Production	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Other Production											
E. Prod. of Haloc. and SF_6											
F. Con. of Haloc. and SF_6											
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Ot. Prod. Use											
4. Agriculture	69.42	70.03	64.92	51.17	50.27	46.29	43.70	41.89	41.61	41.08	41.75
A. Enteric Fermentation	58.54	59.14	54.23	43.08	41.96	37.94	36.20	34.50	34.35	33.93	33.82
B. Manure Management	10.88	10.89	10.69	8.09	8.32	8.35	7.50	7.39	7.26	7.15	7.93
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Presc. Bur. of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Bur. of Agr.Resid.	NE,NO	NE,NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

CTF Table 1 Emission trends (CH_4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	kt CH_4										
5. LULUCF	0.00	0.60	0.60	0.14	1.15	0.52	0.09	0.36	0.57	1.06	0.07
A. Forest Land	0.00	0.60	0.60	0.14	1.15	0.52	0.09	0.36	0.57	1.06	0.07
B. Cropland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	23.81	22.85	23.30	23.74	24.22	24.75	25.38	26.09	26.90	27.76	28.74
A. Solid W. Disp.on Land	10.53	11.55	12.09	12.63	13.20	13.82	14.54	15.32	16.20	17.13	18.18
B. Waste-water Handling	13.27	11.30	11.21	11.11	11.02	10.93	10.84	10.77	10.70	10.63	10.56
C. Waste Incineration	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CO2 emissions including net CO2 from LULUCF	163.14	163.46	151.46	136.41	143.24	132.77	130.75	130.58	134.35	127.47	126.92
Total CO2 emissions excluding net CO2 from LULUCF	163.14	162.87	150.87	136.27	142.09	132.24	130.66	130.22	133.78	126.41	126.86
Memo Items:											
International Bunkers	0.01	0.01	0.01	0.01	0.01	0.01	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	0.00
Marine	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00
Multilateral Operations	C	C	C	C	C	C	C	C	C	C	C
CO2 Emissions from Biomass											

CTF Table 1 Emission trends (CH_4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	kt CH_4									
1. Energy	59.33	64.37	66.85	68.34	69.50	69.14	75.86	82.17	77.84	75.37
A. Fuel Comb. (SA)	6.37	5.19	5.24	6.23	6.06	5.72	5.71	5.08	5.09	5.20
1. Energy Ind.	0.14	0.16	0.19	0.22	0.21	0.20	0.19	0.22	0.19	0.19
2. Manuf. Ind. and Cons.	0.30	0.29	0.28	0.31	0.36	0.33	0.34	0.35	0.33	0.30
3. Transport	1.43	1.22	1.19	1.14	1.07	0.91	0.95	0.91	0.84	0.78
4. Other Sectors	4.49	3.51	3.59	4.56	4.42	4.28	4.24	3.59	3.73	3.93
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Em. from Fuels	52.97	59.18	61.61	62.11	63.44	63.42	70.14	77.09	72.75	70.17
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	52.97	59.18	61.61	62.11	63.44	63.42	70.14	77.09	72.75	70.17
2. Industrial Processes	0.25	0.26	0.21	0.23	0.22	0.20	0.29	0.26	0.19	0.04
A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Chemical Industry	0.25	0.26	0.21	0.23	0.22	0.20	0.29	0.26	0.19	0.04
C. Metal Production	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Other Production										
E. Prod. of Haloc. and SF_6										
F. Con. of Haloc. and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Ot. Prod. Use										
4. Agriculture	40.65	41.54	41.25	43.16	45.20	45.77	47.66	45.95	46.86	47.02
A. Enteric Fermentation	33.28	34.13	33.72	35.28	36.70	38.36	39.10	38.00	39.26	38.81
B. Manure Management	7.37	7.41	7.52	7.89	8.50	7.41	8.57	7.95	7.61	8.21
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Presc. Bur. of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Bur. of Agr.Resid.	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

CTF Table 1 Emission trends (CH_4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	kt CH_4									
5. LULUCF	2.41	0.49	0.25	1.16	0.05	0.05	0.07	0.24	0.18	0.09
A. Forest Land	2.41	0.49	0.25	1.16	0.05	0.05	0.07	0.24	0.18	0.09
B. Cropland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	29.73	30.84	32.11	33.53	34.92	34.03	37.09	39.77	42.64	45.26
A. Solid W. Disp.on Land	19.24	20.47	21.85	23.39	24.82	24.01	27.14	29.86	32.87	35.57
B. Waste-water Handling	10.49	10.37	10.26	10.15	10.09	10.02	9.96	9.91	9.77	9.69
C. Waste Incineration	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CO2 emissions including net CO2 from LULUCF	132.37	137.51	140.67	146.44	149.90	149.19	160.97	168.39	167.71	167.79
Total CO2 emissions excluding net CO2 from LULUCF	129.96	137.01	140.42	145.27	149.85	149.14	160.90	168.15	167.53	167.70
Memo Items:										
International Bunkers	0.00	0.01	0.01	0.01	0.01	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	0.01	0.01	0.01
Marine	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Multilateral Operations	C	C	C	C	C	C	C	C	C	C
CO2 Emissions from Biomass										

CTF Table 1 Emission trends (CH_4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	kt CH_4		
1. Energy	78.46	74.43	7.39
A. Fuel Comb. (SA)	5.72	6.45	-33.71
1. Energy Ind.	0.21	0.22	27.89
2. Manuf. Ind. and Cons.	0.32	0.29	-43.17
3. Transport	0.70	0.66	-59.65
4. Other Sectors	4.49	5.28	-28.72
5. Other	NO	NO	0.00
B. Fugitive Em. from Fuels	72.74	67.98	14.10
1. Solid Fuels	NO	NO	-100.00
2. Oil and Natural Gas	72.74	67.98	18.73
2. Industrial Processes	0.00	0.00	-100.00
A. Mineral Products	NE,NO	NE,NO	0.00
B. Chemical Industry	0.00	0.00	-100.00
C. Metal Production	NE,NO	NE,NO	0.00
D. Other Production			
E. Prod. of Haloc. and SF_6			
F. Con. of Haloc. and SF_6			
G. Other	NO	NO	0.00
3. Solvent and Ot. Prod. Use			
4. Agriculture	46.45	46.27	-33.93
A. Enteric Fermentation	38.48	38.28	-35.28
B. Manure Management	7.96	7.99	-26.61
C. Rice Cultivation	NO	NO	0.00
D. Agricultural Soils	NO	NO	0.00
E. Presc. Bur. of Savannas	NO	NO	0.00
F. Field Bur. of Agr.Resid.	NO	NO	0.00
G. Other	NO	NO	0.00

CTF Table 1 Emission trends (CH_4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	kt CH_4		
5. LULUCF	0.06	0.32	-45.46
A. Forest Land	0.06	0.32	-45.46
B. Cropland	NE,NO	NE,NO	0.00
C. Grassland	NE,NO	NE,NO	0.00
D. Wetlands	NE,NO	NE,NO	0.00
E. Settlements	NE,NO	NE,NO	0.00
F. Other Land	NE,NO	NE,NO	0.00
G. Other	NE	NE	0.00
6. Waste	44.91	46.40	103.07
A. Solid W. Disp.on Land	35.21	36.71	217.73
B. Waste-water Handling	9.69	9.69	-14.19
C. Waste Incineration	NE,NO	NE,NO	0.00
D. Other	NO	NO	0.00
7. Other	NO	NO	0.00
Total CO2 emissions including net CO2 from LULUCF	169.87	167.42	2.42
Total CO2 emissions excluding net CO2 from LULUCF	169.81	167.10	2.60
Memo Items:			
International Bunkers	0.01	0.01	43.39
Aviation	0.01	0.01	267.58
Marine	0.00	0.00	-31.88
Multilateral Operations	C	C	0.00
CO2 Emissions from Biomass			

CTF Table 1 Emission trends (N_2O)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	kt N_2O										
1. Energy	0.37	0.35	0.24	0.22	0.24	0.25	0.23	0.34	0.37	0.30	0.45
A. Fuel Comb. (SA)	0.37	0.34	0.24	0.21	0.24	0.25	0.23	0.34	0.37	0.30	0.44
1. Energy Ind.	0.04	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.04	0.04
2. Manuf. Ind. and Cons.	0.06	0.06	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
3. Transport	0.16	0.14	0.10	0.09	0.12	0.13	0.11	0.20	0.23	0.16	0.31
4. Other Sectors	0.11	0.11	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Em. from Fuels	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial Processes	2.59	2.59	2.28	2.98	2.24	2.43	2.33	2.17	2.28	1.72	2.03
A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Chemical Industry	2.59	2.59	2.28	2.98	2.24	2.43	2.33	2.17	2.28	1.72	2.03
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production											
E. Prod. of Haloc. and SF_6											
F. Con. of Haloc. and SF_6											
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Ot. Prod. Use	NE	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
4. Agriculture	9.26	9.39	9.23	8.23	7.23	7.25	6.89	6.96	7.76	6.91	7.52
A. Enteric Fermentation											
B. Manure Management	1.22	1.23	1.15	0.91	0.89	0.83	0.78	0.73	0.72	0.70	0.72
C. Rice Cultivation											
D. Agricultural Soils	8.04	8.16	8.09	7.32	6.34	6.42	6.11	6.23	7.04	6.21	6.80
E. Presc. Bur. of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Bur. of Agr.Resid.	NE,NO	NE,NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

CTF Table 1 Emission trends (N_2O)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	kt N_2O										
5. LULUCF	0.00	0.02	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.01
A. Forest Land	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.02	0.00
B. Cropland	NE,NO	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	0.25	0.27	0.25	0.25	0.25	0.26	0.28	0.26	0.26	0.26	0.28
A. Solid W. Disp.on Land											
B. Waste-water Handling	0.25	0.27	0.25	0.25	0.25	0.26	0.28	0.26	0.26	0.26	0.28
C. Waste Incineration	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CO2 emissions including net CO2 from LULUCF	12.48	12.74	12.14	11.81	10.12	10.31	9.87	9.87	10.81	9.33	10.39
Total CO2 emissions excluding net CO2 from LULUCF	12.48	12.71	12.12	11.79	10.08	10.29	9.85	9.85	10.79	9.30	10.38
Memo Items:											
International Bunkers	0.01	0.01	0.00	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	0.00	0.01	0.01	0.00	0.01	0.01	0.01
Marine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multilateral Operations	C	C	C	C	C	C	C	C	C	C	C
CO2 Emissions from Biomass											

CTF Table 1 Emission trends (N_2O)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	kt N_2O									
1. Energy	0.48	0.46	0.33	0.36	0.53	0.51	0.37	0.38	0.36	0.36
A. Fuel Comb. (SA)	0.48	0.46	0.33	0.36	0.52	0.51	0.37	0.38	0.36	0.36
1. Energy Ind.	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05
2. Manuf. Ind. and Cons.	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.03	0.03
3. Transport	0.33	0.32	0.18	0.19	0.36	0.35	0.21	0.22	0.21	0.22
4. Other Sectors	0.07	0.06	0.06	0.08	0.07	0.07	0.07	0.06	0.06	0.07
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive Em. 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	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial Processes	2.39	2.01	1.95	1.84	2.24	2.19	2.17	2.39	2.44	2.04
A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Chemical Industry	2.39	2.01	1.95	1.84	2.24	2.19	2.17	2.39	2.44	2.04
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production										
E. Prod. of Haloc. and SF_6										
F. Con. of Haloc. and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Ot. Prod. Use	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
4. Agriculture	7.34	7.90	7.83	7.40	8.05	8.12	8.05	8.52	8.06	7.67
A. Enteric Fermentation										
B. Manure Management	0.70	0.70	0.69	0.72	0.73	0.72	0.75	0.72	0.68	0.68
C. Rice Cultivation										
D. Agricultural Soils	6.65	7.20	7.14	6.69	7.32	7.40	7.31	7.80	7.39	6.99
E. Presc. Bur. of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Bur. of Agr.Resid.	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

CTF Table 1 Emission trends (N_2O)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	kt N_2O									
5. LULUCF	0.05	0.02	0.02	0.03	0.02	0.02	0.02	0.03	0.03	0.03
A. Forest Land	0.04	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
B. Cropland	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	0.27	0.29	0.31	0.31	0.31	0.32	0.33	0.34	0.34	0.34
A. Solid W. Disp.on Land										
B. Waste-water Handling	0.27	0.29	0.31	0.31	0.31	0.32	0.33	0.34	0.34	0.34
C. Waste Incineration	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CO2 emissions including net CO2 from LULUCF	10.64	10.79	10.54	10.06	11.26	11.28	11.06	11.76	11.34	10.55
Total CO2 emissions excluding net CO2 from LULUCF	10.60	10.77	10.53	10.02	11.24	11.26	11.04	11.74	11.32	10.52
Memo Items:										
International Bunkers	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
Aviation	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01
Marine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multilateral Operations	C	C	C	C	C	C	C	C	C	C
CO2 Emissions from Biomass										

CTF Table 1 Emission trends (N_2O)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	kt N_2O		
1. Energy	0.35	0.32	-6.58
A. Fuel Comb. (SA)	0.35	0.32	-6.19
1. Energy Ind.	0.05	0.06	31.47
2. Manuf. Ind. and Cons.	0.03	0.03	-55.38
3. Transport	0.20	0.16	14.93
4. Other Sectors	0.07	0.08	-21.93
5. Other	NO	NO	0.00
B. Fugitive Em. from Fuels	0.00	0.00	-68.44
1. Solid Fuels	NO	NO	0.00
2. Oil and Natural Gas	0.00	0.00	-68.44
2. Industrial Processes	2.63	2.60	0.08
A. Mineral Products	NE,NO	NE,NO	0.00
B. Chemical Industry	2.63	2.60	0.08
C. Metal Production	NO	NO	0.00
D. Other Production			
E. Prod. of Haloc. and SF_6			
F. Con. of Haloc. and SF_6			
G. Other	NO	NO	0.00
3. Solvent and Ot. Prod. Use	0.10	0.10	-8.40
4. Agriculture	7.39	7.59	-19.18
A. Enteric Fermentation			
B. Manure Management	0.66	0.66	-46.42
C. Rice Cultivation			
D. Agricultural Soils	6.73	6.93	-15.07
E. Presc. Bur. of Savannas	NO	NO	0.00
F. Field Bur. of Agr.Resid.	NO	NO	0.00
G. Other	NO	NO	0.00

CTF Table 1 Emission trends (N_2O)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	kt N_2O		
5. LULUCF	0.03	0.02	-0.38
A. Forest Land	0.00	0.01	-45.46
B. Cropland	0.03	0.02	26.53
C. Grassland	NE,NO	NE,NO	0.00
D. Wetlands	NE,NO	NE,NO	0.00
E. Settlements	NE,NO	NE,NO	0.00
F. Other Land	NE,NO	NE,NO	0.00
G. Other	NE	NE	0.00
6. Waste	0.34	0.33	22.69
A. Solid W. Disp.on Land			
B. Waste-water Handling	0.34	0.33	22.69
C. Waste Incineration	NE,NO	NE,NO	0.00
D. Other	NO	NO	0.00
7. Other	NO	NO	0.00
Total CO2 emissions including net CO2 from LULUCF	10.84	10.97	-13.89
Total CO2 emissions excluding net CO2 from LULUCF	10.81	10.94	-13.92
Memo Items:			
International Bunkers	0.01	0.01	40.56
Aviation	0.01	0.01	47.03
Marine	0.00	0.00	-31.88
Multilateral Operations	C	C	0.00
CO2 Emissions from Biomass			

CTF Table 1 Emission trends (HFCs, PFCs and SF_6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	kt										
Em. of HFCs[3] - (Gg CO_2 eq)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-23	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00
HFC-32	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.01	0.01
HFC-125	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134	NO	NO	NO	NO	NO	NO	0.03	0.04	0.05	0.06	0.08
HFC-134a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-152a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.01	0.01
HFC-143a	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspec. mix of listed HFCs[4] - (Gg CO_2 eq)	NO										
Em. of PFCs[3] - (Gg CO_2 eq)	936.56	0.13	0.09	NO	NO	NO	NO	NO	NO	NO	NO
CF_4	0.13	0.01	0.01	NO	NO	NO	NO	NO	NO	NO	NO
C_2F_6	0.01	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_3F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspec. mix of listed PFCs[4] - (Gg CO_2 equivalent)	NO										
Em. of SF6[3] - (Gg CO_2 eq)	11.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CTF Table 1 Emission trends (HFCs, PFCs and SF_6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	kt									
Em. of HFCs[3] - (Gg CO_2 eq)	170.68	193.42	225.11	263.03	300.11	333.47	365.45	405.94	424.16	435.68
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-32	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
HFC-43-10mee	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
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0.09	0.11	0.12	0.15	0.17	0.19	0.21	0.23	0.24	0.25
HFC-152a	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.05
HFC-143	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
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236fa	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
Unspec. mix of listed HFCs[4] - (Gg CO_2 eq)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Em. of PFCs[3] - (Gg CO_2 eq)	NO	NO	NO	NO	NO	NA,NO	NA,NO	NA,NO	NA,NO	0.20
CF_4	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_2F_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_3F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspec. mix of listed PFCs[4] - (Gg CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Em. of SF6[3] - (Gg CO_2 eq)	12.18	12.26	12.59	12.87	13.17	13.66	13.64	13.68	12.55	8.39

CTF Table 1 Emission trends (HFCs, PFCs and SF_6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	Change from base to latest reported year
	kt		
Em. of HFCs[3] - (Gg CO_2 eq)	472.25	475.94	100.00
HFC-23	0.00	0.00	100.00
HFC-32	0.01	0.01	100.00
HFC-41	NO	NO	0.00
HFC-43-10mee	NO	NO	0.00
HFC-125	0.02	0.02	100.00
HFC-134	NO	NO	0.00
HFC-134a	0.27	0.26	100.00
HFC-152a	0.04	NO	0.00
HFC-143	NO	NO	0.00
HFC-143a	0.01	0.02	100.00
HFC-227ea	0.00	0.00	100.00
HFC-236fa	NO	0.00	100.00
HFC-245ca	NO	NO	0.00
Unspec. mix of listed HFCs[4] - (Gg CO_2 eq)	NO	NO	0.00
Em. of PFCs[3] - (Gg CO_2 eq)	0.03	0.01	-100.00
CF_4	NO	NO	-100.00
C_2F_6	NO	NO	-100.00
C_3F_8	NO	NO	0.00
C_4F_{10}	NO	NO	0.00
c-C_4F_8	NO	NO	0.00
C_5F_{12}	NO	NO	0.00
C_6F_{14}	NO	NO	0.00
Unspec. mix of listed PFCs[4] - (Gg CO_2 equivalent)	NO	NO	0.00
Em. of SF6[3] - (Gg CO_2 eq)	9.18	9.58	-12.55

III.3. QUANTIFIED ECONOMY-WIDE EMISION REDUCTION (QEWER) TARGET

Policies and measures to reduce emissions and mitigate climate change are in the function of fulfilling Croatian international obligations under the UNFCCC, the Kyoto Protocol and the EU acquis. The primary goal is fulfilling the obligations of the Kyoto Protocol in reducing greenhouse gas emissions by 5% in the period from 2008 to 2012 in comparison with 1990. By joining the European Union, the Republic of Croatia has taken a common European objective of reducing greenhouse gas emissions by 20% by 2020 in comparison with 1990 with a conditional option to decrease emissions by 30% in accordance with the position of the European Union.
The Republic of Croatia has committed to limit the expected increase in emissions of up to 20% (the positive limit) in relation to the verified emissions from the 2005. Positive limit for Croatia from sectors not covered by the emissions trading system is 11% compared to the verified emissions from the 2005.

For each year in the period from 2013-2020 year, the amount of greenhouse gases emitted from sectors not covered by the emission trading scheme is limited to the annual national quota as determined by Decision 2013/162/EU. The table 4.2-1 from 6th National Communication shows the national annual quota for the period from 2013th to 2020th the Republic of Croatia by the decision.

Further information is provided in CTF Tables 2(a)-(f).

CTF Table 2(a) Description of quantified economy-wide emission reduction target: base year

Party CROATIA		
Base year/base period	1990	
Emission reduction target	%base year/base period 20%	% od 1990 20%
Period for reaching target	2020	

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

Gases covered	Base year for each gas (year)	
CO_2	1990	
CH_4	1990	
N_2O	1990	
HFCs	1990	
PFCs	1990	
SF_6	1990	
NF_3	-	
Other gases	-	
Sectors Covered	Energy	Yes
	Transport	Yes
	Industrial processes	Yes
	Agriculture	Yes
	LULUCF	Yes
	Waste	Yes

CTF Table 2 (c) Description of quantified economy-wide emission reducing target: global warming

National annual quotas are calculated on the basis of the global warming potential of greenhouse gases from the Second Report of the Intergovernmental Committee on Climate Change. The values of the Fourth Assessment Report of the Intergovernmental Committee on Climate Change will become valid when the Conference of the Parties to the UNFCCC decision on their acceptance.

Gases	GWP values*
CO_2	1
CH_4	21
N_2O	310
HFCs	As per GWPs for the range of HFCs in IPCC's Second Assessment Report
PFCs	As per GWPs for the range of PFCs in IPCC's Second Assessment Report
SF_6	23,900
NF_3	-
Other gases	-

*Second Assessment Report of the IPCC

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

Role of LULUCF	LULUCF in base year level target	Included
	Contribution of LULUCF is calculated using	Activity-based approach

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

		Possible scale of contributions (estimated kt CO_2eq)
	CERs	-
	ERUs	-
	AAUs	148778.503*
	Carry-over units	-
	Other mechanism units under the Convention (specify)	-

*Decision 13/CMP.1 requests Parties to submit the initial report prior to 1 January 2007 or one year after the entry into force of the Kyoto Protocol for that Party, whichever is later. The initial report of Croatia was submitted on 27 August 2008, which is in compliance with decision 13/CMP.1. In its initial report Croatia refers to its 2008 greenhouse gas (GHG) inventory submission, comprising common Croatia submitted final revised estimates for the period 1990–2006 on 16 June 2009, which are considered in review report. These revised estimates resulted in revisions of the total GHG emissions in the base year from 32,527,325 t CO2 eq as reported originally by Croatia to 31,321,790 t CO2 eq.

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

		Possible scale of contributions (estimated kt CO_2eq)
	(specify)	Analyses have shown that Croatia could meet the requirements in the first commitment period of the Kyoto Protocol by domestically applied emission reduction measures, which means that use of flexible mechanisms is not planned. In case domestic measures would fail to realize their full potential and meeting the requirements of the Kyoto Protocol would become uncertain, application of flexible mechanisms and possible purchase of emission units in international market would be considered.

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

	The Republic of Croatia has committed to limit the expected increase in emissions of up to 20% (the positive limit) in relation to the verified emissions from the 2005. Positive limit for Croatia from sectors not covered by the emissions trading system is 11% compared to the verified emissions from the 2005.

III.4. PROGRESS IN ACHIEVEMENT OF QEWER TARGET

III.4.1. Mitigation actions and their effects

This chapter gives an overview of relevant policies and measures in accordance with the distribution of targets in the ETS sector, including the capture and geological storage of CO_2 (CCS) and the non-ETS sector in the involved sectors: energy, transport, industrial processes, agriculture, LULUCF, waste management. Measures that have cross-sectoral character are listed too.

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 implementation	Breaf description	Start year of impl.	Implementing entity or entities	Estimate of mitigation impact (not cumulative) in kt CO_2-eq 2015	2020
Involving the plant and aircraft operators in third part of emission trading scheme (EU ETS)	Energy Industry	CO_2 N_2O PFC	emission reduction	Economic	Implemented	See 6th NC chapter 4.2-1, measure: MSP1	2013	MENP CEA	NE	NE
Adaptation of the Plan for use of funds obtained from the sale of emission allowances through auctions	Energy Industry LULUCF	CO_2 N_2O PFC	distribution of funds raised at the auction in projects mitigation and adaptation to climate change	Economic	Implemented	See 6th NC chapter 4.2-1, measure: MSP2	2013	MENP	NE	NE
Preparation of National Feasibility Study with the action plan of the preparatory activities for CCS projects in Croatia	Energy	CO_2	preparing CCS projects in the Republic of Croatia	Regulatory	Planned	See 6th NC chapter 4.2-1, measure: MSP3	2014	ME	NE	NE
Promotion of energy efficiency in households and services through project activities	Energy	CO_2	encourage the use of cost-effective, energy efficient (EE) technologies, materials and services in households and the public sector	Regulatory, Economic, Reporting	Implemented	See 6th NC chapter 4.2-2, measure: MEN-1	2013	UNDP ME	NE	NE
Energy audits in industry	Energy	CO_2	Increase of energy efficiency	Regulatory	Implemented	See 6th NC chapter 4.2-2, measure: MEN-2	2013	MCPP	NE	NE
Measurement and informative calculation of energy consumption	Energy	CO_2	Increase of energy efficiency	Regulatory	Implemented	See 6th NC chapter 4.2-2, measure: MEN-3	2013	ME, Electricity, heat and natural gas suppliers	NE	NE
Promotion of the construction of cogeneration	Energy	CO_2	Achieve the share of electricity production from cogeneration plants by 4% of the total final consumption of electricity	Regulatory, Economic,	Implemented	See 6th NC chapter 4.2-2, measure: MEN-4 and MEN-8	2013	ME	NE	NE
Marking the energy efficiency of household appliances	Energy	CO_2	Increase of energy efficiency	Regulatory, Reporting	Implemented	See 6th NC chapter 4.2-2, measure: MEN-5	2013	ME	NE	NE
	Energy	CO_2	Increase of energy	Regulatory,	Implemented	See 6th NC chapter	2013	ME	NE	NE

Ecological design of energy-using products			efficiency	Reporting		4.2-2, measure: MEN-6				
Encouraging the use of renewable sources in electricity production	Energy	CO_2	emission reduction	Regulatory, Economic	Implemented	chapter 4.2-2, measure: MEN-7	2013	ME	NE	NE
Usage of biodegradable fraction of municipal waste in public electricity and heating plants	Energy	CO_2	emission reduction	Regulatory, Economic	Implemented	See 6th NC chapter 4.2-2, measure: MEN-9	2013	MENP	NE	NE
Usage of refused derived fuel in the cement industry	Energy	CO_2	emission reduction	Regulatory, Economic	Implemented	See 6th NC chapter 4.2-2, measure: MEN-10	2013	MENP	NE	NE
Promotion of the use of renewable energy sources in heat/cooling energy production	Energy	CO_2	emission reduction	Regulatory, Economic	Implemented	See 6th NC chapter 4.2-2, measure: MEN-11	2013	ME	NE	NE
Promotion of the use of renewable energy sources and energy efficiency by HBOR-a	Energy	CO_2	The goal of the loan program is the realization of investment projects focused on environmental protection, improving energy efficiency and promoting renewable energy	Regulatory, Economic	Implemented	See 6th NC chapter 4.2-2, measure: MEN-12	2013	HBOR	NE	NE
Promotion of the use of renewable energy sources and energy efficiency by EPEEF resources	Energy	CO_2	emission reduction	Regulatory, Economic	Implemented	See 6th NC chapter 4.2-2, measure: MEN-13	2013	FZOEU	NE	NE
Energy efficiency projects with implementation through the energy services	Energy	CO_2	Increase of energy efficiency and costs for operation and maintenance	Regulatory, Economic	Implemented	See 6th NC chapter 4.2-2, measure: MEN-14	2013	HEP-ESCO	NE	NE
Prescribing limit values for components and characteristics of liquid petroleum fuels	Energy, Transport	CO_2	defines limit values for components and characteristics of liquid petroleum fuels	Regulatory	Implemented	See 6th NC chapter 4.2-2, measure: MTR-1	2013	MENP	NE	NE
Providing information to consumers on fuel economy and CO2 emission of new passenger cars	Energy, Transport	CO_2	emission reduction	Regulatory, Reporting	Implemented	See 6th NC chapter 4.2-2, measure: MTR-2	2013	MI	NE	NE
The implementation of the pilot project and the establishment of the training of drivers of road vehicles for eco-driving	Energy, Transport	CO_2	energy efficiency in transport	Reporting, Educational	Planned	See 6th NC chapter 4.2-2, measure: MTR-3	2013	MENP, MMATI, MI	NE	NE
Promotion of the production and use of biofuels in transport	Energy, Transport	CO_2	emission reduction	Regulatory, Fiscal	Implemented	See 6th NC chapter 4.2-2, measure: MTR-4	2013	ME	NE	NE
Modification of the system for special fee	Energy,	CO_2	Motivating for	Fiscal	Planned	See 6th NC chapter	2013	MENP	NE	NE

payment for the environment for the motor vehicles	Transport		buying vehicles with lower emissions			4.2-2, measure: MTR-5				
Financial incentives for the purchase of hybrid and electric vehicles	Energy, Transport	CO_2	encourage greater market share of electric and hybrid vehicles	Fiscal	Planned	See 6th NC chapter 4.2-2, measure: MTR-6	2014	MENP, ME	NE	NE
Development of infrastructure for electric vehicles in urban areas	Energy, Transport	CO_2	infrastructure development, primarily charging stations or battery exchange stations	Fiscal	Planned	See 6th NC chapter 4.2-2, measure: MTR-7	2014	ME, MMATI	NE	NE
Development of sustainable transport systems in urban areas	Energy, Transport	CO_2	development of sustainable transport systems	Research and developing	Planned	See 6th NC chapter 4.2-2, measure: MTR-8	2013	MENP, Local government	NE	NE
Abolition and reduction of consumption of controlled and new substances and fluorinated greenhouse gases	Industry	F gases	Prohibition of production, import, export, drain, placing on the market	Regulatory	Implemented	See 6th NC chapter 4.2-3, measure: MOS-1	2013	MENP	NE	NE
Technical and organizational measures for collecting, recycling and recovering controlled substances and fluorinated greenhouse gases	Industry	F gases	recovery of fluorinated greenhouse gases	Regulatory	Implemented	See 6th NC chapter 4.2-3, measure: MOS-2	2013	MENP	NE	NE
Preventive measures for the prevention of uncontrolled leaking	Industry	F gases	leakage preventing	Regulatory	Implemented	See 6th NC chapter 4.2-3, measure: MOS-3	2013	MENP	NE	NE
Preparation of Study about possibilities of applying measures to reduce greenhouse gas emissions in the agricultural sector	Agriculture	CH_4, N_2O	emission reduction	Research and developing	Planned	See 6th NC chapter 4.2-4, measure: MSP-4	2014	MA, MENP	NE	NE
Improving the reporting from LULUCF sector	LULUCF	CO_2	establish adequate monitoring for all carbon deposits	Research and developing	Planned	See 6th NC chapter 4.2-4, measure: MSP-5	2013	MENP, MA	NE	NE
Preparation of cost-benefit analysis of reforestation on new surfaces and biological regeneration of forests as a measure of increasing sinks in LULUCF sector	LULUCF	CO_2	Making analysis of the possibilities of increasing outflow application of afforestation	Research and developing	Planned	See 6th NC chapter 4.2-4, measure: MSP-6	2014	MENP, MA	NE	NE
Revision of reference levels for Forest Management (FMRL) under Article 3.4 of the Kyoto Protocol for the second commitment period	LULUCF	CO_2	Use of outflow in second assessment period	Research and developing, Regulatory	Planned	See 6th NC chapter 4.2-4, measure: MSP-7	2014	MENP, MA	NE	NE
Development of Action plan for LULUCF sector	LULUCF	CO_2	Use of outflow in second assessment period	Research and developing, Regulatory	Planned	See 6th NC chapter 4.2-4, measure: MSP-8	2014	MENP, MA	NE	NE
Avoiding generation and reducing the quantity of municipal waste	Waste	CH_4	amount of waste reduction	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure:	2005	Local (regional) self-government	NE	NE

						MSP-9				
Increasing the quantity of sorted and recycled municipal waste	Waste	CH_4	amount of waste reduction	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure: MSP-10	2005	Local (regional) self-government	NE	NE
Increasing the population coverage of organized municipal waste collection system	Waste	CH_4	amount of waste reduction	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure: MSP-11	2005	LOCAL Local (regional) self-government	NE	NE
Methane flaring or using methane as fuel for electricity production	Waste	CH_4	CH_4 emission reduction	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure: MSP-12	2007	Local (regional) self-government, electricity and heat producers	NE	532.70
Reducing the quantities of disposed biodegradable municipal waste	Waste	CH_4	reduce the amount of biodegradable waste	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure: MSP-13	2005	Local (regional) self-government	NE	152.58
Production of fuel from waste	Waste	CH_4	CH_4 emission reduction	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure: MSP-14	2007	Local (regional) self-government, electricity and heat producers	NE	NE
Use of biogas from bioreactors for electricity and heat production	Waste	CH_4	CH_4 emission reduction	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure: MSP-15	2007	Local (regional) self-government, electricity and heat producers	NE	NE
Thermal processing of municipal waste and sludge from wastewater treatment	Waste	CH_4	CH_4 emission reduction	Regulatory	Planned	See 6th NC chapter 4.2-4, measure: MSP-16	2014	Local (regional) self-government	NE	NE
Establishing a monitoring, reporting and verification of greenhouse gas emissions in the lifetime of liquid fuels	Intersectoral	CO_2, CH_4, N_2O	emission reduction	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure: MSP-17	2013	MENP	NE	NE
CO2 emission tax	Intersectoral	CO_2	emission reduction	Regulatory	Implemented	See 6th NC chapter 4.2-4, measure: MSP-18	2007	MENP	NE	NE
The establishment of committee for intersectoral coordination for policies and measures to mitigate and adapt to climate change and Committee for intersectoral coordination for a national system for monitoring greenhouse gas emissions	Intersectoral	CO_2, CH_4, N_2O	emission reduction	Regulatory	Planned	See 6th NC chapter 4.2-4, measure: MSP-18	2014	MENP	NE	NE
Intensifying the use of innovative information and communication technologies (ICT) to reduce greenhouse gas emissions	Intersectoral	CO_2, CH_4, N_2O	emission reduction	Educational	Planned	See 6th NC chapter 4.2-4, measure: MSP-18	2014	MENP	NE	NE

III.4.2. Estimates of emission reduction and removals and the use of units from market-based mechanisms and Land use, land use change and forestry activities

Information is provided in CTF Tables 4, 4(a) and 4(b).

CTF Table 4: Reporting on progress

Year	Total emissions excluding LULUCF (kt CO_2 eq)	Contribution from LULUCF (kt CO_2 eq)	Quantity of units from market based mechanisms under the Convenrtion (number of units and kt CO_2 eq)	Quantity of units from market based mechanisms (number of units and kt CO_2 eq)
Base year/base period; 1990	31,321.79	-4,184.92	-	-
2010	28,711.06	-5,485.16	-	-
2011	28,278.50	-5,468.65	-	-

CTF Table 4(a)I: 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 20XX-3

For emission calculation Croatia use LULUCF approach that is based on table 1 (CRF tables), therefore do not need to complete table 4(a)I

CTF Table 4(a)II: 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 change and forestry sector in relation to activities under Article 3, paragraphs 3and 4 of the Kyoto Protocol

Greenhouse gas source and sink activities	Base year	Net emission/removals					Accounting parameters	Accounting quantity
A. Article 3.3 activities								
A.1. Afforestation and Reforestation								-731.11
A.1.1. Units of land not harvested since the beginning of the commitment period(2)		-178.51	-182.37	-178.65	-191.58	-731.11		-731.11
A.1.2. Units of land harvested since the beginning of the commitment period(2)								NO
A.2. Deforestation		495.87	441.86	411.35	371.59	1,720.68		1,720.68
B. Article 3.4 activities								
B.1. Forest Management (if elected)		-6,044.51	-6,071.48	-6,086.09	-6,035.05	-24,237.13		-4,858.33
3.3 offset(3)							989.57	0.00
FM cap(4)							4,858.33	-4,858.33
B.2. Cropland Management (if elected)	0.00	NA	NA	NA	NA	NA	0.00	0.00
B.3. Grazing Land Management (if elected)	0.00	NA	NA	NA	NA	NA	0.00	0.00
B.4. Revegetation (if elected)	0.00	NA	NA	NA	NA	NA	0.00	0.00

Table 4(b) Reporting on progress

	Kyoto Protocol units (kt CO_2 eq)										Other units (kt CO_2 eq)			
	AAUs		ERUs		CERs		tCERs		ICERs		Units from market-based mechanisms under the Conventon		Units from other market-based mechanisms	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
	NE	NE	0	0	0	0	0	0	0	0	0	0	0	0
	Quantity of units													
			2011								2012			
	Total		0								0			

III.5. PROJECTIONS

In the Sixth national communication emissions are reported for three scenarios: scenario "without measures" scenario "with measures" scenario "with additional measures'. The scenario "without measures" exclude the application, approval and planning of any policy or measure after year selected for the initial year of scenarios. Scenario "with measures" provides the application of policies and measures applicable process which is already underway, and implementation of policies and measures that have been adopted. Scenario "with additional measures" based on the application of planned policies and measures.

Emission projections are based on conditions and projections of macroeconomic parameters from 2010. Comparisons of emission projections are shown relative to the base year emissions.

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

Key underlying assumptions	Historical							Projected			
	1990	1995	2000	2005	2010	2011	2012	2015	2020	2025	2030
Real GDP growth rate (%)	NE	6.8	2.9	4.2	-1.2	0.0	0.0	3.5	4.0	3.0	2.5
Population, (mid-year estimate),'000	4778	4669	4426	4440	4425	4403	4403	4405	4366	4320	4267
Coal price EUR/GJ	NE	NE	NE	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09
Fuel oil price EUR/GJ	NE	NE	NE	10.12	10.12	10.12	10.12	10.12	10.12	10.12	10.12
Natural gas price EUR/GJ	NE	NE	NE	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69
The degree-day heating	NE	NE	NE	2.479	2.479	2.479	2.479	2.479	2.479	2.479	2.479
The number of heating days	NE	NE	NE	167	167	167	167	167	167	167	167

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

	GHG emissions and removals (kt CO_2 eq)							GHG emission projections (kt CO_2 eq)	
	Base year	1990	1995	2000	2005	2010	2011	2020	2030
Sector									
Energy	18,079.02	18,701	13,797	14,885	16,991	14,970	16,907.79	17,147	19,002
Transport	4,069.97	4,095	3,466	4,597	5,681	6,040	5,888.70	6,643	5,910
Industry/Industrial processes	4,185.46	3,905.50	2,124.20	2,965.95	3,476.34	3,387.20	3,161.37	3,009	3,703
Agriculture	4,328.40	4,380.72	3,054.84	3,130.16	3,477.70	3,265.21	3,323.49	3,668	3,866
Forestry/LULUCF	-4,184.92	-5,632.48	-6,049.35	-6,901.42	-7,086.28	-5,485.16	-5,468.65	-9,472.8	-8,923.6
Waste management/waste	578.72	564.49	618.62	707.33	814.40	1,049.51	1,078.28	922	875
Other (specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas									
CO_2 emissions including net CO_2 from LULUCF	18,895.52	17,686.10	11,146.05	13,121.93	16,378.79	15,817.33	15,408.48	24,083.88	25,435.25
CO_2 emissions excluding net CO_2 from LULUCF	23,080.45	23,338.72	17,201.66	20,088.78	23,472.18	21,312.42	20,891.56	14,611.13	16,511.63
CH_4 emissions including net CH_4 from LULUCF	3,425.89	3,432.71	2,745.81	2,779.85	3,133.04	3,567.32	3,515.92	3,764.35	4,097.16
CH_4 emissions excluding net CH_4 from LULUCF	3,425.87	3,420.21	2,743.94	2,729.15	3,131.92	3,566.01	3,509.10	3,764.35	4,097.16
N_2O emissions including net N_2O from LULUCF	3,867.89	3,948.40	3,058.46	3,299.69	3,495.58	3,359.80	3,399.92	2,887.15	2,995.77
N_2O emissions excluding net N_2O from LULUCF	3,867.89	3,940.75	3,054.07	3,284.97	3,489.60	3,351.18	3,392.30	2,887.15	2,995.77
HFCs	NO	NO	49.37	170.68	333.47	472.25	475.94	640.95	809.62
PFCs	936.56	936.56	NO	NO	NA,NO	0.03	0.01	IE	IE
SF_6	11.01	10.95	11.66	12.18	13.66	9.18	9.58	12.87	17.76
Other (specify, e.g. NF_3)	NO	NO	NO	NO	NO	NO	NO	17.76	17.76
Total with LULUCF	27,136.87	26,014.72	17,011.35	19,384.34	23,354.54	23,225.91	22,809.85	21,916.44	24,431.94
Total without LULUCF	31,321.79	31,647.20	23,060.70	26,285.76	30,440.82	28,711.06	28,278.50	31,389.19	33,355.56

CTF Table 6(b) Information on updated greenhouse gas projections under a 'without measures' scenario

	GHG emissions and removals (kt CO_2 eq)							GHG emission projections (kt CO_2 eq)	
	Base year	1990	1995	2000	2005	2010	2011	2020	2030
Sector									
Energy	18,079.02	18,701	13,797	14,885	16,991	14,970	16,907.79	21,672	30,423
Transport	4,069.97	4,095	3,466	4,597	5,681	6,040	5,888.70	7,059	7,185
Industry/Industrial processes	4,185.46	3,905.50	2,124.20	2,965.95	3,476.34	3,387.20	3,161.37	3,958	4,730
Agriculture	4,328.40	4,380.72	3,054.84	3,130.16	3,477.70	3,265.21	3,323.49	3,747	3,948
Forestry/LULUCF	-4,184.92	-5,632.48	-6,049.35	-6,901.42	-7,086.28	-5,485.16	-5,468.65	-7,653.8	-7,761.3
Waste management/waste	578.72	564.49	618.62	707.33	814.40	1,049.51	1,078.28	1,608	1,679
Other (specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas									
CO_2 emissions including net CO_2 from LULUCF	18,895.52	17,686.10	11,146.05	13,121.93	16,378.79	15,817.33	15,408.48	28,963.72	38,019.09
CO_2 emissions excluding net CO_2 from LULUCF	23,080.45	23,338.72	17,201.66	20,088.78	23,472.18	21,312.42	20,891.56	21,309.93	30,257.75
CH_4 emissions including net CH_4 from LULUCF	3,425.89	3,432.71	2,745.81	2,779.85	3,133.04	3,567.32	3,515.92	4,811.70	5,356.25
CH_4 emissions excluding net CH_4 from LULUCF	3,425.87	3,420.21	2,743.94	2,729.15	3,131.92	3,566.01	3,509.10	4,811.70	5,356.25
N_2O emissions including net N_2O from LULUCF	3,867.89	3,948.40	3,058.46	3,299.69	3,495.58	3,359.80	3,399.92	3,613.98	3,763.50
N_2O emissions excluding net N_2O from LULUCF	3,867.89	3,940.75	3,054.07	3,284.97	3,489.60	3,351.18	3,392.30	3,613.98	3,763.50
HFCs	NO	NO	49.37	170.68	333.47	472.25	475.94	640.95	809.62
PFCs	936.56	936.56	NO	NO	NA,NO	0.03	0.01	IE	IE
SF_6	11.01	10.95	11.66	12.18	13.66	9.18	9.58	12.87	17.76
Other (specify, e.g. NF_3)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total with LULUCF	27,136.87	26,014.72	17,011.35	19,384.34	23,354.54	23,225.91	22,809.85	30,389.42	40,204.89
Total without LULUCF	31,321.79	31,647.20	23,060.70	26,285.76	30,440.82	28,711.06	28,278.50	38,043.22	47,966.23

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

	GHG emissions and removals (kt CO_2 eq)							GHG emission projections (kt CO_2 eq)	
	Base year	1990	1995	2000	2005	2010	2011	2020	2030
Sector									
Energy	18,079.02	18,701	13,797	14,885	16,991	14,970	16,907.79	17,147	12,819
Transport	4,069.97	4,095	3,466	4,597	5,681	6,040	5,888.70	6,643	5,310
Industry/Industrial processes	4,185.46	3,905.50	2,124.20	2,965.95	3,476.34	3,387.20	3,161.37	3,009	3,703
Agriculture	4,328.40	4,380.72	3,054.84	3,130.16	3,477.70	3,265.21	3,323.49	3,668	3,866
Forestry/LULUCF	-4,184.92	-5,632.48	-6,049.35	-6,901.42	-7,086.28	-5,485.16	-5,468.65	-10,737.6	-10,509.7
Waste management/waste	578.72	564.49	618.62	707.33	814.40	1,049.51	1,078.28	922	875
Other (specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas									
CO_2 emissions including net CO_2 from LULUCF	18,895.52	17,686.10	11,146.05	13,121.93	16,378.79	15,817.33	15,408.48	24,083.88	18,694.60
CO_2 emissions excluding net CO_2 from LULUCF	23,080.45	23,338.72	17,201.66	20,088.78	23,472.18	21,312.42	20,891.56	13,346.23	8,184.94
CH_4 emissions including net CH_4 from LULUCF	3,425.89	3,432.71	2,745.81	2,779.85	3,133.04	3,567.32	3,515.92	3,764.35	4,084.09
CH_4 emissions excluding net CH_4 from LULUCF	3,425.87	3,420.21	2,743.94	2,729.15	3,131.92	3,566.01	3,509.10	3,764.35	4,084.09
N_2O emissions including net N_2O from LULUCF	3,867.89	3,948.40	3,058.46	3,299.69	3,495.58	3,359.80	3,399.92	2,887.15	2,966.84
N_2O emissions excluding net N_2O from LULUCF	3,867.89	3,940.75	3,054.07	3,284.97	3,489.60	3,351.18	3,392.30	2,887.15	2,966.84
HFCs	NO	NO	49.37	170.68	333.47	472.25	475.94	640.95	809.62
PFCs	936.56	936.56	NO	NO	NA,NO	0.03	0.01	IE	IE
SF_6	11.01	10.95	11.66	12.18	13.66	9.18	9.58	12.87	17.76
Other (specify, e.g. NF_3)	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total with LULUCF	27,136.87	26,014.72	17,011.35	19,384.34	23,354.54	23,225.91	22,809.85	20,651.54	16,063.25
Total without LULUCF	31,321.79	31,647.20	23,060.70	26,285.76	30,440.82	28,711.06	28,278.50	31,389.19	26,572.91

III.6. PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY-BUILDING SUPPORT TO DEVELOPING COUNTRY PARTIES

The Republic of Croatia became a party to the Convention on 17 January 1996 when the Croatian Parliament passed the law on its ratification (OG, International Treaties 2/96). For the Republic of Croatia the Convention came into force on 7 July 1996. As a country undergoing the process of transition to market economy, Croatia has, pursuant to Article 22, paragraph 3 of the Convention, assumed 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. Therefore Croatia is not required to provide financial or any other assistance to developing countries, because Croatia is one of them. This section applies to developed countries, countries included in Annex II of the Convention.

III.7. OTHER REPORTING REQUIREMENTS

Annex I Parties are encouraged to report, to the extent possible, on the domestic arrangements established for the process of the self-assessment of compliance with emission reductions in comparison with emission reduction commitments. Annex I Parties are encouraged to report, to the extent possible, on the progress made in the establishment of national rules for taking local action against domestic non-compliance with emission reduction targets.

Annex I Parties are encouraged to report any other information that the Partyconsiders relevant to the achievement of the objective of the Convention and suitable for inclusion in its biennial report

CTF Table 7(b) Provision of public financial support: contribution through bilateral, regional and other channels in 2011.

Recipient country And/or region	Target area	Measures and activities related to technology transfer	Sector	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information
NE	NE	NE	NE	NE	NE	NE	NE
