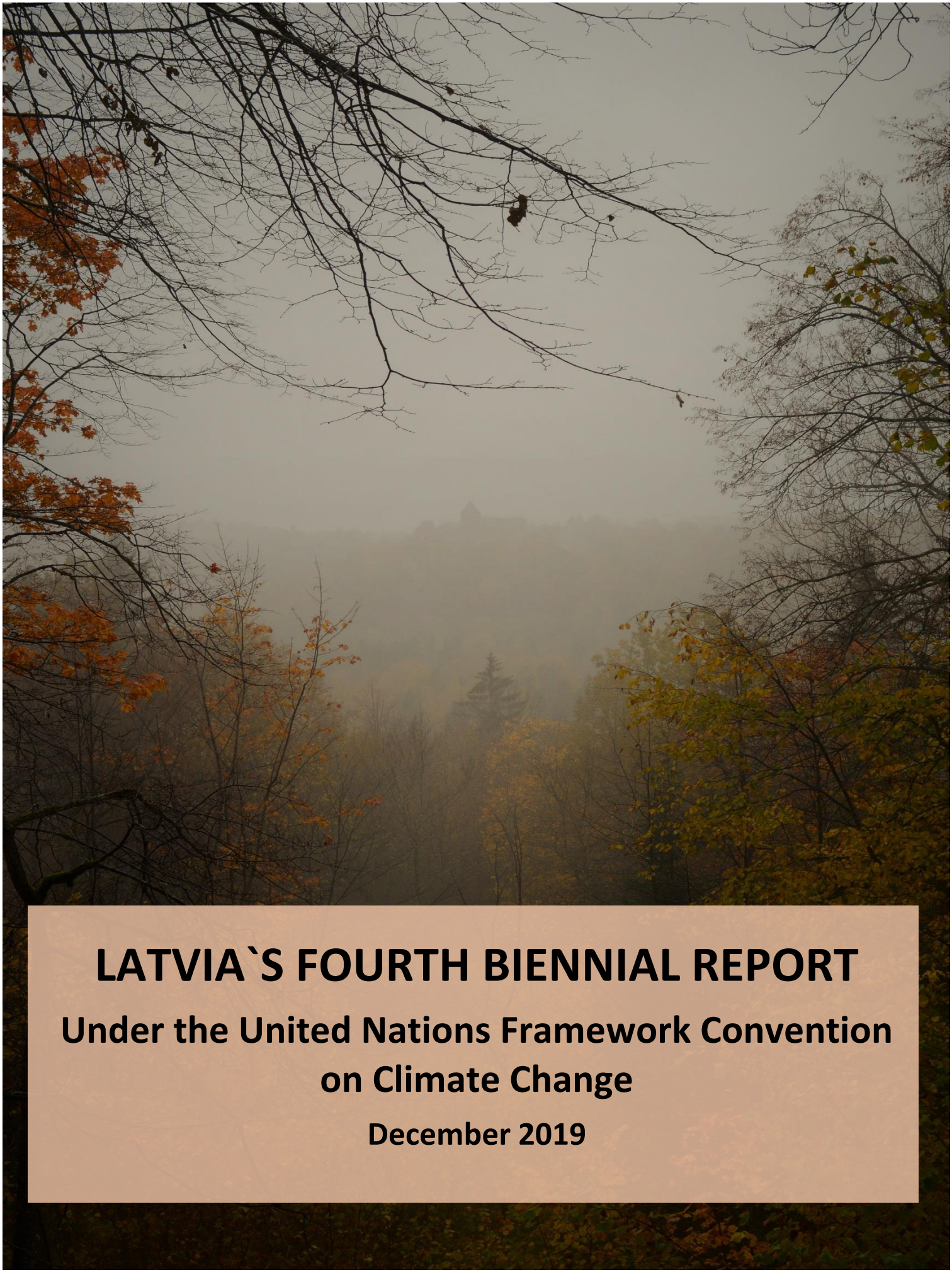

LATVIA`S FOURTH BIENNIAL REPORT

Under the United Nations Framework Convention on Climate Change

December 2019

DATA SHEET

Title

LATVIA'S FOURTH BIENNIAL REPORT under the United Nations Framework Convention on Climate Change

Date

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CONTENTS

ABREVIATIONS

AEAs - Annual Emission Allocations
AU - Animal units
AAU – Assigned Amount Units
BR3 – Third biennial report
BR4 – Fourth biennial report
CAP - Common Agricultural Policy
CCFI - Climate Change Financial Instrument
CF - Cohesion Fund
CH_4 – Methane
CO_2 – Carbon dioxide
CO_2 eq. – Carbon dioxide equivalent
CO – Carbon monoxide
CoM Regulation No. 737 (12.12.2017.) - Regulations of the Cabinet of Ministers No. 737 adopted on 12 December 2017 "Development and management of national system for greenhouse gas inventory and projections"
COP - Conference of the Parties
CRF – Common reporting format
CTF – Common tabular format
CSB – Central Statistical Bureau
CHP - Combined heat and power plants
DH - District heating
DOC - Degradable organic carbon
EC - European Commission
EMEP/EEA 2016 - EMEP/EEA air pollutant emission inventory guidebook 2016
EAAI - Emission Allowances Auctioning Instrument
EAFRD - European Agriculture Fund for Rural Development
EEA – European Economic Area
EEOS - Energy Efficiency Obligation Scheme
EMS - Energy Management Systems
EPI - Energy performance indicator
EU – European Union
EU ETS – European Union Emission Trading Scheme
EU ESD - European Union Effort Sharing Decision
ETS – Emission Trading Scheme
EU MMR – European Union Monitoring Mechanism Regulation
ESD – Effort Sharing Decision
ERDF - European Regional Development Fund
EV - Electric Vehicles
FADN - Farm Accountancy Data Network
FEC - Final energy consumption
FIT - Feed-in tariffs
GE - Gross energy

GHG – Greenhouse Gases
GDP – Gross domestic producēt
GPEC - Gross primary energy consumption
HAC - High activity clays
HFC – Hydrofluorocarbon
IE – Included elsewhere
IET - International emissions trading
IPCC – Intergovernmental Panel on Climate Change
2006 IPCC Guidelines – 2006 IPCC Guidelines for National Greenhouse Gas Inventories
IPCC Wetlands Supplement - 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands
2013 IPCC Kyoto Protocol Supplement - 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol
IPE – Institute of Physical Energetics
IPPC - Integrated Pollution Prevention Control
IPPU – Industrial processes and product use
LASAM - Latvian Agricultural Sector Analysis Model
LEGMC – Latvian Environment, Geology and Meteorology Centre
LULST - Latvia University of Life Sciences and Technologies
LULUCF – Land Use, Land Use Change and Forestry
KP – Kyoto protocol
MBT - Mechanical Biological treatment
MCF - Methane conversion factor
MFA - Ministry of Foreign Affairs of the Republic of Latvia
MS – Member states
MoA - Ministry of Agriculture of the Republic of Latvia
MoE – Ministry of Economic of the Republic of Latvia
MoT - Ministry of Transport of the Republic of Latvia
MEPRD - Ministry of Environmental Protection and Regional Development of the Republic of Latvia
MMS – Manure management system
NFI – National forest inventory
N_2O – Nitrous oxide
NOx – Nitrogen oxides
NA – Not applicable
ND - Nitrates Directive
NDP2020 - The National Development Plan 2014–2020
NE – Not estimated
NIR – National inventory report
NIS – National system
NMVOC - Non-methane volatile organic compounds
NRP - National Reform Programme
Non-ETS – non Emission trading sheme
NO – Not occuring in Latvia
ODS - Ozone-depleting substances

PAM - Policies and measures
PFC – Perfluorocarbon
PT – Public transport
QA/QC – Quality assurance and Quality control
RES - Renewable energy sources
SF_6 – Sulphur hexafluoride
SO_2 – Sulphur dioxide
SWD - Solid waste disposal
UNFCCC – United Nations Framework Convention on Climate Change
UUA - Utilised agricultural area
UWWTD - Urban Waste Water Treatment Directive 91/271/EEC
VA – Value added
WEM_HD - Alternative scenario
WEM - scenario with existing measures
WAM - scenario with additional measures
WFD - Water Framework Directive

1. INTRODUCTION

This report represents Fourth biennial report of the Republic of Latvia under Article 12 of the United Nations Framework Convention on Climate Change, under Article 7 of the Kyoto Protocol and according to the decisions 2/CP.17 and 9/CP.16 of the Conference of the Parties under the UNFCCC. It covers issues related to the implementation of the UNFCCC by Latvia and shows progress Latvia is making towards meeting its goals.

Information provided on greenhouse gas emissions and trends is consistent with information in Latvia's GHG inventory submission in 2019[1].

In 2010 the EU submitted a pledge to reduce its GHG emissions by 2020 by 20% compared to 1990 levels. This target under the UNFCCC has only been submitted by EU-28 and not by each of its Member State, namely, Latvia as part of the EU-28 takes on a quantified economy-wide emission reduction target jointly with all MSs. In 2009 under the EU 2020 Climate and Energy Package, the EU introduced clear internal rules to achieve the 20% reduction of total GHG emissions compared to 1990 levels, which is equivalent to a 14% reduction compared to 2005 levels. This 14% reduction objective is divided between EU Emission trading scheme and non-ETS sectors. The EU ETS target is to be achieved by the EU as a whole. The vast majority of emissions within the EU which fall outside the scope of the EU ETS are non-ETS emissions addressed under the Effort Sharing Decision (Decision No. 406/2009/EC). The ESD target was divided into national targets compared to 2005 levels, to be achieved individually by each MS. Latvia's emission reduction target for 2020 includes the positive limit +17% compared to 2005 established for ESD sector in line with ESD. The data compiled in this report shows that Latvia is on track to reach this ESD target.

The report also includes information on the provision of financial, technological and capacity-building support to Parties not included in Annex I to the Convention.

Common Tabular Format tables according to the Decision 19/CP.18 – Common tabular format for "UNFCCC biennial reporting guidelines for developed country Parties" (FCCC/CP/2012/8/Add.3) – are enclosed as Annex to this report and are submitted separately to the UNFCCC using the CTF software.

[1] Latvia's national inventory submission 2019, https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019

2. INFORMATION ON GREENHOUSE GAS EMISSION INVENTORIES

2.1. National Circumstances

At the beginning of 2017 population of Latvia was 1,950,000. During the last three decades, since 1990, population has decreased by about 717,000. At the beginning of 2017 in Riga, the capital of Latvia, the population was 641,400 people, constituting 32.9% of the entire population of the country. At the beginning of 2017 the population density in Latvia was 30 people per 1 km².

The territory covers an area of 64,573 km^2 in total. There are more than 3,000 lakes and 12,000 rivers in Latvia. Total forest area (including afforested lands) in 2017 was 31,916.3 km^2, cropland 19,286.9 km^2 and grassland 6,254.1 km^2, wetland 4,597.3 km^2, settlements 2,464.2 km^2.

As the economy of Latvia is small and open there is significant dependence on the trends of global economy. Foreign trade is important, with exports of goods and services accounting for about 45% of the gross domestic product. The services sector had the dominating share in Latvia value added total followed by manufacturing and construction, while the agriculture sector and other industries had a minor role. In 2017 the most important sectors in the manufacturing industry were wood processing, food and beverages, fabricated metal products, non-metallic minerals, electrical appliances, machinery and equipment.

In 2017 the Total primary energy consumption was 4.56 Mtoe. Today three types of energy sources, each of an approximately equal share, dominate in the supply of primary energy sources in Latvia: oil products (40.3%), which are mainly petrol and diesel fuel used in the transport sector; natural gas (22.6%), mainly for generating electricity and heat in combined heat and power plants; wood biomass (35.5%), used for heating in different sectors and generating electricity and heat in CHPs. Latvia depends on the import of primary sources, however, Latvia's dependency has decreased from 86% (in 1990) to 61% (in 2017), mainly due to increasing the use of wood biomass and other renewable energy sources.

In 2017 the final energy consumption was 4.1 Mtoe. The transport sector's share in the final energy consumption was 30.3%. The second largest share in the final energy consumption was in the residential sector, constituting 29.3% but share of industry was about 20.8%.

Road transport constitutes the largest share of energy consumption in transport. In 2017 passenger cars, trucks, buses and motorcycles used about 95% of the total consumption in transport.

2.2. Greenhouse Gas Inventory Information

This section presents summary information on the national greenhouse gas emissions since 1990. The information is consistent with the most recent annual inventory submission to the UNFCCC where detailed information on GHG emissions and their estimation can be found.

Description of emission trends by sector

As a Party to the UNFCCC and the Kyoto Protocol as well as being a Member State of the EU, Latvia has an obligation to prepare, publish and submit GHG inventories on an annual basis.

The annual submission (National inventory report and Common reporting format tables) contains emission estimates for the time series since 1990 till year prior to the previous year (x-2).

The GHG inventory is prepared according to the UNFCCC Decision 24/CP.19 Annex I reporting guidelines "Guidelines for the preparation of national communications by Parties included in Annex I of the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories on annual inventories", the 2006 IPCC Guidelines for National Greenhouse Gas inventories, 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands and 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol.

The emission data presented in this chapter and in CTF table 1 are based on the Latvia's national greenhouse gas inventory 1990-2017, submitted to the UNFCCC on 12 April 2019[2]. Table 2.1 and Figure 2.1 shows a time series of CO_2 equivalent emissions by sectors without LULUCF, including indirect CO_2.

Table 2.1 Latvia GHG emissions by source sector, kt CO_2 eq.

	1990	1995	2000	2005	2010	2015	2017
1.Energy	19288.96	9463.06	7313.32	8054.42	8448.13	7169.06	7225.19
2.Industrial processes and product use	654.31	210.92	234.55	319.54	700.31	755.16	733.48
3.Agriculture	5616.57	2595.97	2248.85	2384.47	2480.26	2769.93	2782.32
4.Land Use, Land-Use Change and Forestry	-9828.92	-12375.33	-8751.41	-3184.96	77.63	1696.83	-1706.85
5.Waste	699.62	623.34	691.04	629.50	650.54	561.77	565.21
Indirect CO_2	40.30	32.16	24.70	21.22	16.03	17.02	19.13
Total (without LULUCF, with indirect)	26299.76	12925.45	10512.46	11409.15	12295.27	11272.95	11325.33
Total (with LULUCF, with indirect)	16470.84	550.12	1761.05	8224.19	12372.89	12969.78	9618.48

According to Table 2.1 in 2017, Latvia's GHG emissions composed 11325.33 kt CO_2 eq. excluding LULUCF in total including indirect CO_2, showing in 2017 a decrease of 56.9% comparing to the base year 1990. The largest decrease is observed in Energy sector – 62.5% followed by the 50.5% decrease in Agriculture sector. In Waste sector GHG emissions decrease is 19.2%.

[2]Latvia's national inventory submission 2019, https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019

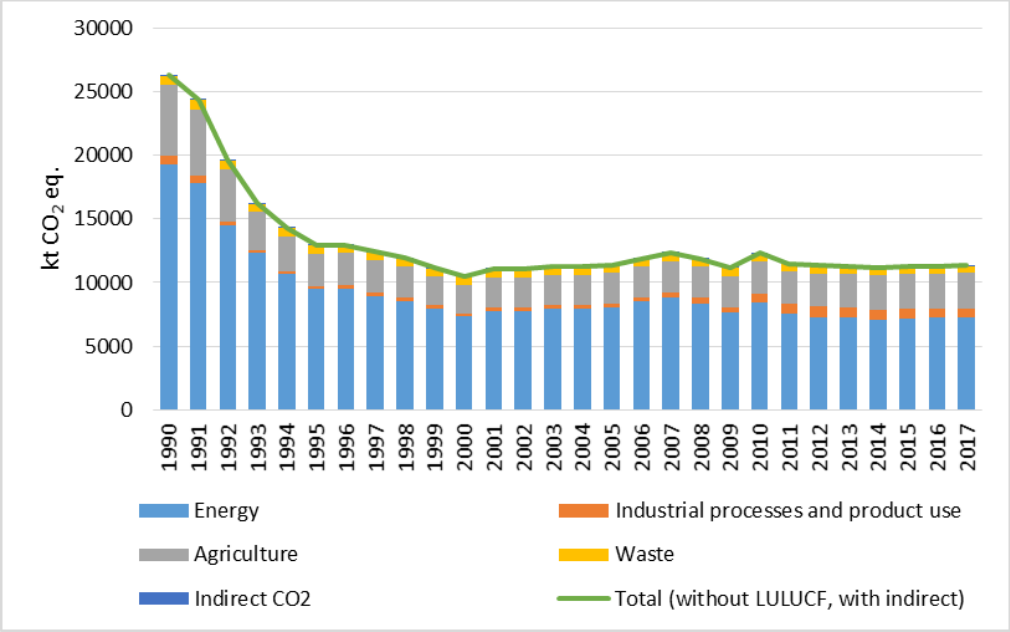

Figure 2.1 GHG emission time series for 1990–2017, kt CO_2 eq.

GHG emissions had considerably decreased during the time period 1990–1995 (50.9%) when the national economy of Latvia transformed from central planning economy to a market economy. This transformation created structural changes of the economy: the share of industry in GDP had considerably decreased and, on the contrary, the share of services – increased. The IPPU and Agriculture sectors had in this period the largest decrease of GHG emissions against 1990, respectively 67.8% and 53.8%.

The rapid growth of Latvia's economy in the period 2000-2007, during which GDP growth constituted 82.4%, resulted also in the growth of the total GHG emissions by 17.6%. In its turn, in the period 2008-2017 the active implementation of climate policies and measures took place, which decreased GHG emissions in 2017 per 4.8% compared to 2008.

Total GHG emissions in 2017, compared to 2016, were by 0.3% higher. This increase was ensured mainly due to emissions increase (by 11.8%) in Industrial processes and product use sector because of increased cement production. At the same time the increase of emissions in Agriculture sector (by 0.6%) have been noted.

The Energy sector is the most significant source of GHG emissions in Latvia with about 63.8% (7225.19 kt CO_2 eq.) share of the total emissions in 2017. This reflects extensive consumption of energy for a long heating period, as well as energy consumption for Transport that composes 46.0% (according to the latest submission) of emissions in the Energy sector. There are not many energy-intensive manufacturing branches in Latvia. Energy-related CO_2 emissions vary mainly according to the economic trend, energy supply structure and climate conditions including the impact on hydropower production and electricity import.

Agriculture was the second most significant source of GHG emissions in 2017, accounting for almost 24.6% (2782.32 kt CO_2 eq.) of total emissions. Emissions from agricultural soils contributed a major share of the total emissions from the sector – 60.8%, enteric fermentation emissions were second

largest source from the sector – 31.2%. The share of manure management emissions have been evaluated as 6.8% of total emissions in the sector, remaining 1.2% of emissions refer to liming and urea application. GHG emissions increased in 2017 by 0.6% compared to 2016 due to increase of sheep, poultry, productivity of dairy cattle, as well as area of managed organic soil and the increase of lime and urea application to soils.

Emissions from IPPU were 6.5% (733.48 kt CO_2 eq.) of total GHG emissions in Latvia in 2017, being the third largest source of GHG emissions. Largest part of GHG emissions in the IPPU sector constitute emissions from mineral industry (61.0% of total emissions from IPPU sector). The second largest source is product uses as ODS substitutes creating 32.0% from all IPPU emissions. Considerably smaller are the rest of IPPU emission sources – other product manufacture and use, non energy products from fuels and solvents use constituting together 7.0% from entire IPPU emissions in 2017. The share of IPPU from the total GHG emissions has varied from 2.2 to 6.5% of total emissions during the time period 2000 – 2017. The fluctuation in the emissions from IPPU is largely consistent with the economic trend, even if the factors influencing the emissions are more diverse.

The Waste sector accounted for 5.0% (565.21 kt CO_2 eq.) of total GHG emissions in Latvia in 2017. In 2017 GHG emissions from the Waste sector were by 19.2% lower compared to the base year and by 5.9% compared to 2016.

The following Figure 2.2 shows the total GHG emissions including LULUCF sector.

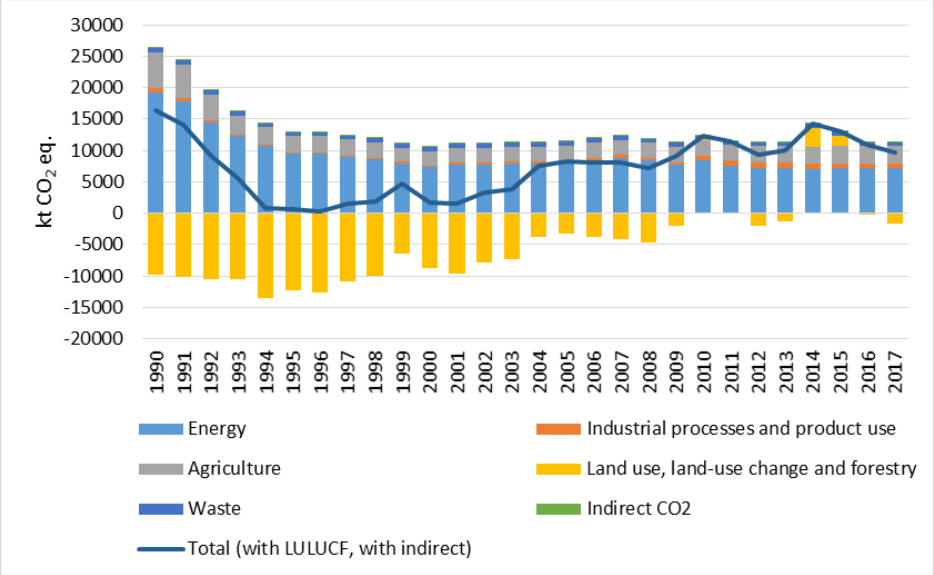

Figure 2.2 GHG emissions in Latvia by reporting sector (with LULUCF), kt CO_2 eq.

In 2017 total emissions of aggregated GHGs in LULUCF sector were -1706.85 kt CO_2 eq. Aggregated net removals of the GHG were reduced by 82.6% in 2017 compared to 1990. Decrease of removals from LULUCF sectors is related to increase of harvesting stock in mature forests with increase of natural mortality due to ageing of forest stands and reduction of increment in ageing forests, furthermore, considerable role in the increase of GHG emissions had conversion of forest land to settlements, as well as conversion of naturally afforested lands to cropland and grassland. Land use conversion to cropland is associated mostly to removal of woody vegetation from naturally afforested farmlands abandoned in 1980s and 1990s. Although the increment of living biomass in forest land remaining forest and

afforested land is still larger than the carbon losses due to commercial felling and natural mortality, the gap between gains and losses is decreasing, causing reduction of the net removals of CO_2 in forest land.

Description of emission trends by gas

Latvia's GHG emissions presented by gas are shown in the Table 2.2.

Carbon dioxide is the main greenhouse gas causing climate change. In 2017 CO_2 emissions constitute 64.0% of Latvia's total greenhouse gas emissions, excluding LULUCF and indirect CO_2. In 2017 total CO_2 emissions had decreased by around 62.9% since 1990. The most important source of CO_2 emissions in 2017 was fossil fuel combustion – 92.8%, from which energy industries – 22.5%, manufacturing industries and construction – 9.3%; transport – 48.7%, other sectors (agriculture, forestry, etc.) – 19.3%. Other anthropogenic emission sources of CO_2 are Industrial processes and product use – 6.7%, Agriculture – 0.5% and Waste 0.004%.

Main sources of CH_4 emissions in Latvia are enteric fermentation of livestock, solid waste disposal sites and Energy sector. Other important sources of CH_4 emissions are leakage from natural gas pipeline systems and combustion of biomass. CH_4 emissions in 2017 contribute to approximately 16.0% of total GHG emissions (excluding LULUCF, indirect CO_2). Methane emissions decreased by 49.0% in 2017 since 1990.

Agricultural soils are the main source of N_2O emissions in Latvia generating 83.8% of all N_2O emissions in 2017. Other N_2O emission sources are from Energy, IPPU and Waste sector. Since 1990, total N_2O emissions had decreased by 37.2% in 2017, mainly due to the decrease in the emissions from Agriculture sector.

Emissions from HFCs and SF_6 consumption are reported for the period 1995-2017. In 2017 F-gases constitute 2.2% form Latvia`s total greenhouse gas emissions. Total F-gases emissions (kt CO_2 eq.) decreased in 2017 compared to 2016 by 2.2%. SF_6 emissions from electrical equipment contribute 10.32 kt CO_2 eq. in 2017.

Table 2.2 Latvia's GHG emissions (without LULUCF, without indirect CO_2), kt CO_2 eq.

	1990	1995	2000	2005	2010	2015	2017
Carbon Dioxide	19504.91	9090.49	7065.17	7812.76	8553.97	7278.85	7235.24
Methane	3537.27	2087.52	1808.05	1787.44	1728.91	1728.11	1804.63
Nitrous Oxide	3217.28	1712.61	1599.58	1728.95	1822.94	2019.29	2021.09
Hydrofluorocarbons, Perfluorocarbons, Sulphur Hexafluoride	NO,NA	2.67	14.96	58.78	173.41	229.67	245.24
Total (without LULUCF, without indirect CO_2)	26259.46	12893.29	10487.76	11387.93	12279.23	11255.92	11306.20

Indirect greenhouse gases

The emissions trends of indirect greenhouse gases; nitrogen oxides, carbon monoxide and non-methane volatile organic compounds and sulphur oxide and other sulphur emissions calculated as sulphur dioxide are presented in Table 2.3.

Table 2.3 Indirect GHG emissions, kt

Year	NOx	CO	NMVOC	SO_2
1990	94.05	450.22	79.44	100.45
1995	49.64	344.16	58.71	49.39
2000	39.77	267.64	48.70	17.75
2005	42.02	220.77	48.29	8.75
2010	40.56	153.65	40.17	4.32
2015	37.70	120.71	40.03	3.57
2017	37.13	126.01	38.00	3.97

In the period from 1990 to 2017 indirect GHG emissions have decreased: NOx by 60.5%, CO by 72.0% and NMVOC by 52.2%. SO_2 emissions have decreased significantly from 1990 to 2017 by 96.0%. Taking into account that amount of the indirect GHG emissions, except NMVOC emissions, in a great extent are determined by the fuel combustion in Energy sector, GHG emissions' decrease in the period of 1990-1995 was mainly caused by the rapid decrease of fuel consumption in this sector. However, in the subsequent years there were different causes for the reduction of different indirect GHGs emissions. SO_2 emissions decrease took place mainly due to implementation of more stringent regulations regarding maximum sulphur content in the liquid fuels utilized in both Energy sector stationary sources and transport (mobile sources) as well as fuel switch to renewables. The decrease of NOx emissions was mainly caused by the wider penetration of new state-of-art technologies in Energy sector (in stationary sources as well as in transport vehicles due to the implementation of catalytic converters), this penetration was favoured by the implementation of regulations regarding NOx emissions specific values from large combustion plants and all types of road transport (passenger cars, HDV and LDV). The biggest part of CO emission reduction is resulting from increased amount of cars with catalytic converters.

In 2017 the most important sector producing indirect GHG emissions (including fugitive emissions) was Energy sector. Fuel combustion in Energy sector causes the largest part of NOx emissions (83.6% from total NOx emissions in 2017), but IPPU and Agriculture sectors make 4.7% and 11.4% respectively. Very small part of NOx emissions is produced in LULUCF sector – 0.2% from total NOx emissions). Almost all CO emissions (94.6%) appear in Energy sector, mainly from fuel combustion in residential and commercial/institutional subsectors (72.1% from all CO emissions). A small part of CO emissions come from LULUCF sector (4.4%) and IPPU sector (1.0%). The major part of SO_2 emissions (97.9%) comes from Energy sector (fuel combustion), then 2.1% SO_2 emissions are from IPPU (cement production), and a negligible part of SO_2 comes also from Waste sector (waste incineration). The largest amounts of NMVOC emissions are produced in Energy sector (50.8%), mainly from fuel combustion in residential sector, and 28.4% from total NMVOC emissions in 2017 are produced in IPPU sector, mainly from sector solvent use. 19.8% of NMVOC emissions are produced in Agriculture sector, but the remaining 1.0% in Waste sector.

2.3. National inventory arrangements

This section provides a summary of National System for preparing Latvia's GHG inventory.

Detailed information of institutional arrangements can be found in Latvia's inventory 2019 submitted under the UNFCCC.

Institutional arrangements

Latvia's national GHG inventory system is designed and operated according to the guidelines for national system under article 5, paragraph 1, of the Kyoto Protocol and Decision 19/CMP.1 to ensure the transparency, consistency, comparability, completeness and accuracy of the inventory.

Latvia's GHG inventory is compiled according to Regulations of the Cabinet of Ministers No. 737 adopted on 12 December 2017 "Development and management of national system for greenhouse gas inventory and projections" (CoM Regulation No. 737 (12.12.2017.)). This legislative enactment regulates institutional cooperation for establishment and maintenance of the national GHG inventory system, including data collection mechanism and the reporting procedure. Climate Change Department of the Ministry of Environmental Protection and Regional Development is responsible for the implementation and development of climate change mitigation and adaptation (and related) policies and measures. MEPRD is responsible for the actions (coordination, implementation and development) to meet the international and EU emission reduction targets. MEPRD also coordinates the monitoring and reporting of GHG emission data as well as is designated as the single national entity with overall responsibility for the Latvian GHG inventory.

The main institutions involved in the compilation of the Latvia's GHG inventory are the MEPRD, Latvian Environment, Geology and Meteorology Centre, Latvian State Forest Research Institute "Silava", Latvia University of Life Sciences and Technologies, Institute of Physical Energetics. A schematic model for the national system is shown in Figure 2.3.

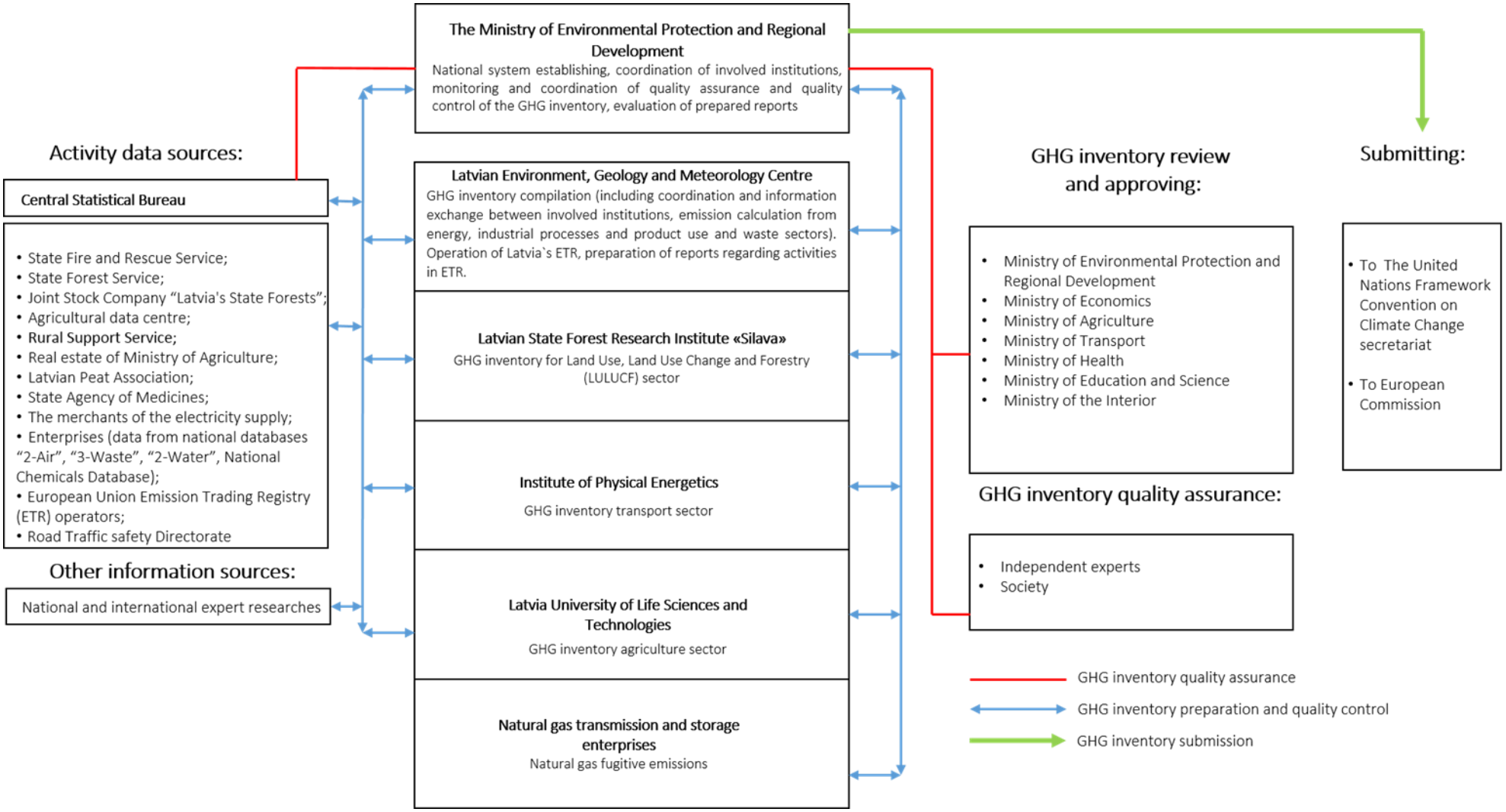

Figure 2.3 The structure of Latvia`s National Inventory System

Latvian Environment, Geology and Meteorology Centre is a governmental limited liability company and is responsible for collecting of activity data and calculation of emissions for Energy, Industrial processes and product use and Waste sectors.

Calculations of removals and emissions for the LULUCF, KP-LULUCF sector are done by Latvian State Forest Research Institute "Silava" in collaboration with Ministry of Agriculture. "Silava" is responsible for collecting of activity data, preparation of the removals/emission estimates, preparation of QC procedures as well as documentation and archiving of used materials for calculation.

Institute of Physical Energetic calculates emissions for Transport sector. IPE is responsible for collecting of activity data, preparation of the emission estimates, preparation of QC procedures as well as documentation and archiving of used materials for calculation.

Emission calculation from Agriculture sector were done by Latvia University of Life Sciences and Technologies in collaboration with MoA. LULST is responsible for collecting of necessary activity data cooperating with Central Statistical Bureau, preparation of the emission estimates, preparation of QC procedures as well as documentation and archiving of used materials for calculation.

The main data supplier for the Latvian GHG inventory is the Central Statistical Bureau.

For ensuring the continuity of the functions of the national system, the delegation agreement is signed between the MEPRD and LEGMC. The delegation agreement ensures the accomplishing of emission estimations and information preparation in the Energy, Industrial processes and product use and Waste sectors for the inventory, as well as GHG inventory compilation and activities related to the EU ETS.

Additionally there are agreements with “Silava”, IPE and Latvia University of Life Sciences and Technologies for emission estimations and information preparation accordingly for LULUCF, Transport and Agriculture sectors.

Before final GHG inventory is submitted to the European Commission and to the UNFCCC secretariat it is forwarded to the involved ministries for review and approval. Based on received comments inventory is corrected appropriately.

Several meetings (related to Energy, LULUCF, Agriculture, Industrial processes and product use, Waste) were held before and during the preparation of inventory to discuss and agree on the methodological issues, problems that have risen and improvements that need to be implemented. There was discussion on the different problems that came up during the last inventory preparation to find solutions on how to improve the overall system.

Inventory process and quality management

The organizations responsible for the preparation and reporting of Latvia’s GHG inventory and their duties are described above.

All experts responsible for data collection and processing in a particular sector are preparing their data (activity data, emission factors) for import into CRF Reporter software. The preparation of the annual inventory based on schedule of the reporting under EU MMR and UNFCCC.

Figure 2.4 shows the annual inventory process how the inventory is prepared within the national system.

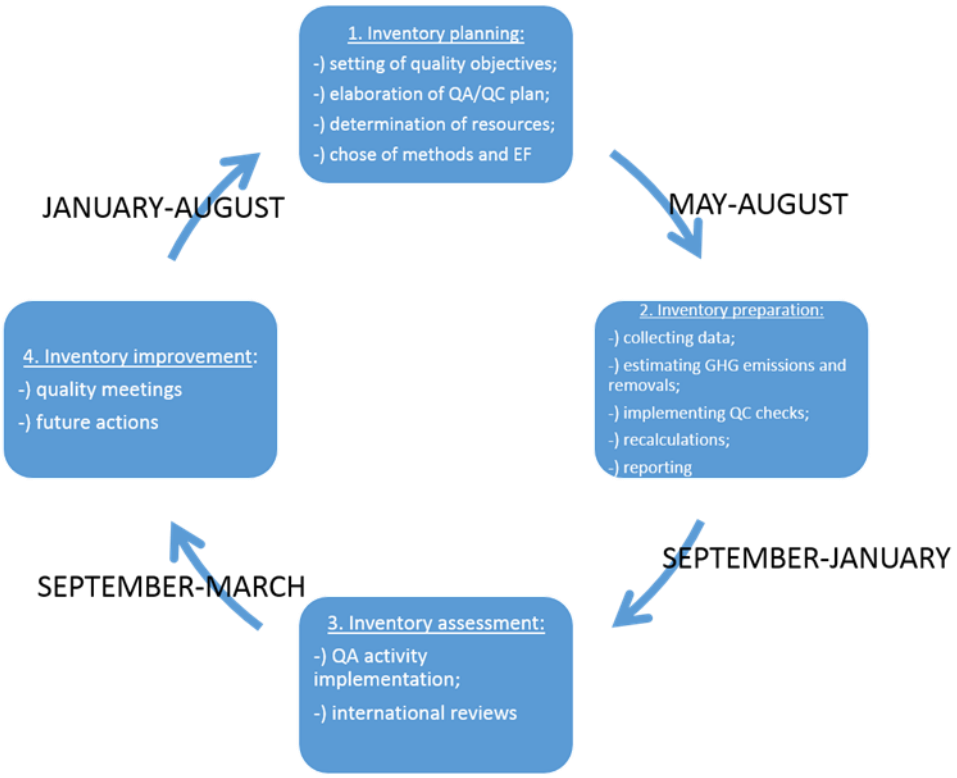

Figure 2.4 Inventory process

During the preparation of 2019 submission, all processes relevant to the GHG inventory have been restructured according to the 2006 IPCC Guidelines and the revised CRF tables. Detailed descriptions of the activity data and methodologies used can be found in the sectoral chapters of the National Inventory Report 2019.

Tier 1 is used to identify key categories for time period 1990-2017. The identification is divided in two parts, key categories excluding LULUCF and key categories including LULUCF source categories. Key categories that have been identified are used for improving the GHG inventory as well results of key category analysis are included annually in the National Inventory Report.

According to CoM Regulation No. 737 (12.12.2017.) all institutions involved in the inventory process are responsible for implementing QC procedures.

The inventory planning stage includes the setting of quality objectives and elaboration of the QA/QC plan for the coming inventory preparation, compilation and reporting work. The quality requirements set for the annual inventories – transparency, consistency, comparability, completeness, accuracy, improvements and timelines.

The setting of quality objectives is based on the inventory principles taking into account the available resources.

In order to ensure improvements:

- All improvements promised in the NIR are carried out;
- Feedback on reviews is systematic;
- Inventory QC procedures meet requirements.

In order to ensure transparency:

- Transparent information is included in the NIR and CRF (including information regarding the used methodology, activity data and emissions in tables);
- Key words and indicators are used according to the IPCC guidelines;
- Recommendations of inventory reviews regarding transparency are taken into account as far as possible;
- Documentation regarding quality control check is indicated;
- A summary regarding the changes since the last inventory in relation to transparency is provided in the NIR.

In order to ensure consistency:

- Time series are consistent;
- Recommendations received during the inventory review regarding consistency is taken into account after evaluation as far as possible;
- Information regarding consistency and recalculations is provided in the NIR;
- An explanation for a decline or increase in emissions of time series is provided.

In order to ensure comparability:

- Methodologies and formats used in the inventory meet comparability requirements;
- Emissions and CO_2 removal is localized and distributed according to the IPCC.

In order to ensure completeness:

- Emissions from all potential sources and gases is calculated;
- Recommendations of review – international experts – regarding improvements is taken into account as far as possible;
- Information regarding completeness is provided in the NIR;
- All reasons for recalculations and reasons why a designation NE (not evaluated) and IE (included elsewhere) is used instead of data is indicated.

In order to ensure accuracy:

- Tier 2 or a higher method is used for the main sources as far as possible;
- Uncertainties are calculated and information is provided in the NIR;
- A summary regarding changes in uncertainties and regarding improvements in comparison with the previous inventory is provided in the NIR.

In order to ensure timeliness:

- Inventory reports reach their recipient (EU/UNFCCC) within the time set.

The QA reviews are performed after the implementation of QC procedures to the finalised inventory. The inventory QA system comprises reviews to assess the quality of the inventory.

A basic review of the draft GHG emission and removal estimates and the draft report takes place before the final submissions to the EU and UNFCCC (January to March) by the involved institutions on GHG inventory preparation process.

The draft of National inventory report was sent to CSB, MoA, and MoT for checking and approving.

UNFCCC review reports indicate the issues where inventory need improvements and elaboration. The improvement plan for GHG inventory is compiled based on the findings of the UNFCCC, EC, internal reviews and recommendations from third part experts.

Quality Assurance activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process. Periodically all sectors are revised by third part experts.

All institutions involved in GHG inventory preparation process are responsible for archiving the collected data and estimated emissions. Latvia has a centralized archiving system – all information (including corresponding letters, internal documentation on QA/QC procedures, external and internal reviews, documentation on annual key sources and key source identification, planned inventory improvements) used for inventory compilation are collected on the special server and the backup of data are made periodically. All information is archived at LEGMC. Common, password protected FTP folder is used for information storage and exchange.

Process and quality management of projections

Under Article 12 of the Regulation (EU) No. 525/2013 Member States were obliged to set up the National system for reporting on PaMs and projections by the 9 of July 2015[3]. Regulations of the Cabinet of Ministers No. 737 "Development and management of national system for greenhouse gas inventory and projections" was adopted in 2017. Main changes are related to the determination of institutions that are responsible for preparation of GHG projections as well as includes the overal information on Quality Assurance/Quality Control procedures for projections preparation. In 2018 QA/QC programme was adopted by Order No. 1-2/160 (03.10.2018) of MEPRD in accordance with the Regulation No. 737. QA/QC programme determines specific tasks and timetable for preparation of projections.

The scheme of the institutional arrangements is shown in Figure 2.5. Institutions involved in the preparation of the projections are as follows:

[3] Latvia's first report on national system for reporting on policies and measures, http://cdr.eionet.europa.eu/lv/eu/mmr/art04-13-14_lcds_pams_projections/envvz6luw/National_Systems_Art_13_MMR_Latvia.pdf

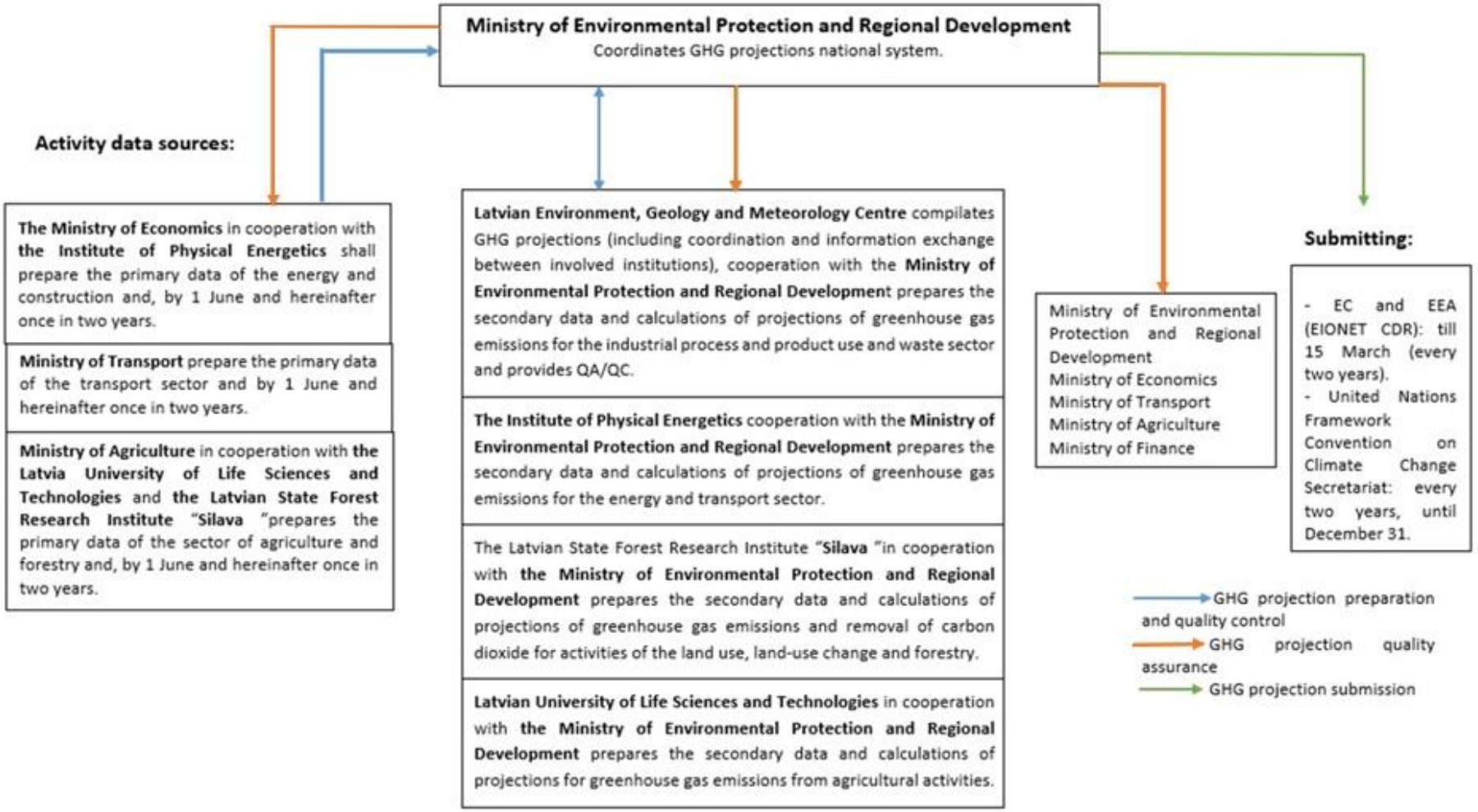

Figure 2.5 National system for the preparation of greenhouse gas projections

MEPRD ensures the submission of the GHG emission/removals projections to the relevant international institutions (European Comimission, UNFCCC) and monitor the co-operation of the authorities involved.

MoE by 30 April 2018 prepares and hereinafter once in two years submits the macroeconomic indicators. MoE in cooperation with the Institute of Physical Energetics prepares the primary data of the energy and construction and, by 1 June 2018 and hereinafter once in two years.

LEGMC:

1) by 1 June 2018 prepares and hereinafter once in two years:
   - submits the primary data - projections of indicators of the waste management and wastewater management sector;
   - prepares the secondary data and calculations of projections of greenhouse gas emissions.
   - submits a description of greenhouse gas projections, policy and measures for the activities of industrial processes;
   - maintains and administers the part of greenhouse gas projections of the integrated database.
2) prepares a draft report on the policy, measures, and greenhouse gas projections (measures for the activities of Energy, Transport, Agriculture, Industrial processes use of hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride and solvents and different chemical substances, LULUCF and Waste management activities).
3) in cooperation with other institution prepares a biennial report.

MoA in cooperation with the Latvia University of Life Sciences and Technologies and the Latvian State Forest Research Institute “Silava” prepares the primary data of the sector of Agriculture and Forestry and, by 1 June 2018 and hereinafter once in two years.

Latvian State Forest Research Institute "Silava" in cooperation with the MEPRD prepares the secondary data and calculations of projections of GHG emissions and removal of carbon dioxide for activities of Land use, land-use change and forestry.

Institution of Physical Energetics cooperation with the MEPRD prepares the secondary data and calculations of projections of greenhouse gas emissions for the Energy and Transport sector.

LULST in cooperation with MEPRD prepares the secondary data and calculations of projections for greenhouse gas emissions from Agriculture activities.

Every second year MEPRD submits to the European Commission (until 15 March) and the UNFCCC Secretariat (until 31 December) Report on Policies and Measures and GHG projections.

Changes in GHG inventory arrangements since BR3

Since the Third biennial report[4] under the UNFCCC, QA/QC program by Order No. 1-2/160 (03.10.2018) of Minister of the Ministry of Environmental Protection and Regional Development was updated, according to CoM Regulation No. 737 (12.12.2017). These changes were introduced in order to improve the preparation of inventory and its preparation process. Other agreements regarding responsibilities are maintained and continue to be in force according to the national legislation (CoM Regulation No. 737 (12.12.2017)). No other changes in institutional, legal, administrative and procedural arrangements

[4]Latvia`s Third biennial report https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-reports-annex-i-parties/third-biennial-reports-annex-i

used for domestic compliance, monitoring, reporting, archiving of information and evaluation of the progress towards its economy-wide emission reduction target have been made.

3. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

This section explains Latvia's emission reduction target as a Member State of the European Union under the UNFCCC and the target compliance architecture set up within the country in order to meet that target.

3.1. The EU target under the Convention

In 2010 the EU submitted a pledge to reduce its GHG emissions by 2020 by 20% compared to 1990 levels. This target under the Convention has only been submitted by EU-28 and not by each of its Member States, namely, Latvia as part of the EU-28 takes on a quantified economy-wide emission reduction target jointly with all MSs. Thus, there are no specified Convention targets for each EU MS.

The definition of the EU target under the UNFCCC for 2020 is documented in the revised note provided by the UNFCCC Secretariat[5]. In addition, the EU provided additional information relating to its quantified economy wide emission reduction target in a submission as part of the process of clarifying the developed country Parties' targets in 2012[6].

Table 3.1 Key facts of the Convention target of the EU-28[7]

Parameters	Target
Base Year	*1990*
Target Year	*2020*
Emission Reduction target	*-20% in 2020 compared to 1990*
Gases covered	*CO_2, CH_4, N_2O, HFCs, PFCs, SF_6*
Global Warming Potential	*AR4*
Sectors Covered	*All IPCC sources and sectors, as measured by the full annual inventory and international aviation to the extent it is included in the EU ETS*
Land Use, Land-Use Change, and Forests (LULUCF)	*Accounted under KP, reported in EU inventories under the Convention. Assumed to produce net removals*
Use of international credits (JI and CDM)	*Possible subject to quantitative and qualitative limits*
Other	*Conditional offer to move to a 30% reduction by 2020 compared to 1990 levels as part of a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities*

3.2. The 2020 Climate and Energy package

In 2009 under the EU 2020 Climate and Energy Package, the EU has set internal rules to achieve the 20% reduction of total GHG emissions from 1990 levels, which is equivalent to a 14% reduction compared to 2005 levels. This 14% reduction objective is divided between ETS and non-ETS sectors. The two sub-targets are:

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

[5] FCCC/SB/2011/INF.1/Rev.1of7, June 2011.
[6] The EU submission is documented in FCCC/AWGLCA/2012/MISC.1
[7] Source: European Commission

The EU ETS target is to be achieved by the EU as a whole, under the revised EU ETS Directive[8], a single ETS cap covers EU MSs and the three participating non-EU countries (Norway, Iceland and Liechtenstein) and there are no further individual caps by country. For allowances allocated to the EU ETS sectors, annual caps have been set for the period from 2013 to 2020; these decrease by 1.74% annually, starting from the average level of allowances issued by MS for the second trading period (2008-2012). The annual caps imply interim targets for emission reductions in sectors covered by the EU ETS for each year until 2020. For further information on the EU ETS and for information on the use of flexible mechanisms in the EU ETS see the fourth Biennial Report of the European Union.

The vast majority of emissions within the EU which fall outside the scope of the EU ETS are addressed under the Effort Sharing Decision (Decision No. 406/2009/EC). The ESD covers emissions from all sources outside the EU ETS, except for emissions from domestic and international aviation (which were included in the EU ETS from 1 January 2012), international maritime emissions, and emissions and removals from LULUCF. It thus includes a diverse range of small-scale emitters in a wide range of sectors: transport (cars, trucks), buildings (in particular heating), services, small industrial installations, fugitive emissions from the Energy sector, emissions of fluorinated gases from appliances and other sources, Agriculture and Waste.

The monitoring and review process under ESD are harmonized for all EU MS by the Monitoring Mechanism Regulation[9]. The use of flexible mechanisms is possible under the ESD.

While the EU ETS target is to be achieved by the EU as a whole, the ESD target was divided into national targets, expressed as percentage changes from 2005 levels, to be achieved individually by each MS. The target levels have been set on the basis of MSs' relative GDP per capita. In addition, different levels of development in the EU-28 are taken into account by the provision of several flexibility options.

Latvia's emission reduction target for 2020 includes the positive limit +17% compared to 2005 established for ESD sector in line with Effort Sharing Decision. By 2013 European Commission Decisions (EC 2013)[10,11], these percentage changes have been transferred into binding quantified annual reduction targets for the period from 2013 to 2020, denominated in Annual Emission Allocations.

3.3. Other emission reduction targets

In addition to the EU target under the Convention, Latvia as the member of the EU also committed to a legally binding quantified emission limitation reduction commitment for the second commitment period of the Kyoto Protocol (2013-2020).

[8] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (OJ L 140, 05.06.2009, p. 63), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32009L0029

[9] Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC

[10] Commission decision of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No. 406/2009/EC of the European Parliament and of the Council (2013/162/EU), http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013D0162&from=EN

[11] Commission Implementing Decision of 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No. 406/2009/ EC of the European Parliament and of the Council (2013/634/EU), http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013D0634&from=EN

4. PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

For the quantification of the progress to 2020 targets, the development of GHG emissions is the key indicator.

Latvia's institutional, legal, administrative and procedural arrangements used for domestic compliance, monitoring, reporting, archiving of information and evaluation of the progress towards economy – wide emission reduction target is shown in Figure 4.1.

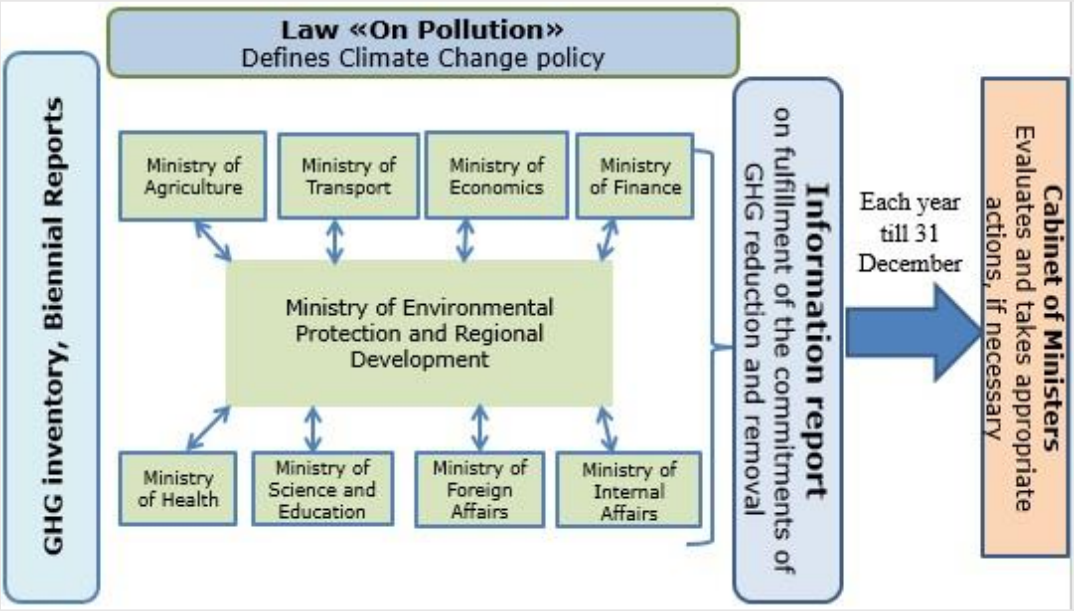

Figure 4.1 Institutional framework for domestic compliance

Law "On Pollution" is the defining Climate Change policy document in Latvia. According to the amendment of Law "On Pollution" (2018), the Ministry of Environmental Protection and Regional Development in cooperation with Ministry of Agriculture, Ministry of Transport, Ministry of Economics and other ministries each year prepare and submit by 31 December an informative report to the Cabinet of Ministers on fulfillment of the commitments regarding GHG emission reduction and CO_2 removals. The following information shall be included in the above mentioned informative report:

- Evaluation of the fulfilment of the comitments related to reduction of GHG and CO_2 removals;
- If necessary, proposals regarding additional measures for the fulfilment of the commitments related to reduction of GHG emissions and CO_2 removals, corresponding to the sectoral policy planning documents for the relevant period which are cost efficient and have been evaluated from the socio – economic point of view.

In 2018, amendments to the **Law "On Pollution"** were approved with the following goals:

- to determine the conditions for fulfillment of the commitments on climate change mitigation (GHGs reduction and CO_2 removals) under the UNFCCC as well as the EU regulation up until 2030 for sectors not included in the EU ETS, include giving delegation to develop necessary policies;

- to adapt Latvian legislation to the EU regulation regarding the participation of aviation activities in the EU ETS;
- to remedy possible shortcomings in the failure to transpose the provisions of the EU regulation that were indicated for Latvia;
- to determine the conditions for using financial resources obtained by the EU ETS operators and aircraft operators;
- to prepare and submit, by 31 December each year, an informative report to the Cabinet of Ministers on fulfillment of the commitments for reduction of GHG emissions and CO_2 removals;
- to set obligatory conditions for sea ships (regulation 2015/757[12]) and requirements for fuel suppliers regarding GHG emission reduction for fuels;
- to include provisions from the Fuel Quality Directive which set an obligation for fuel suppliers to reduce life cycle GHG emissions unit of energy from fuel and energy supplied by 6% in 2020.

Target under the UNFCCC of a reduction of emissions by 20% from 1990 to 2020 only refers to the emissions of the EU-28 as a whole. GHG emissions of EU-28 are calculated as the sum of MSs emissions. With this, GHG emissions of Latvia are part of EU-28 (+ Iceland) emissions with 0.3% from total EU emissions in 2017.

Latvia's emission trends 1990–2017 are reported in detail in CTF Table 1. The development of GHG emissions is reported in CTF Table 4.

Emissions in the LULUCF sector are not included under the Convention target, therefore they are not included in CTF Tables 4 and 4(a).

The use of flexible mechanisms takes place on the one hand by operators in the EU ETS, on the other hand by governments for the achievement of ESD targets. For information on the use of flexible mechanisms under the EU ETS please see the 4th BR under the UNFCCC of the European Union.

Latvia met ESD target with national measures in 2013-2017 (see Table 4.1). This will be the case also for further years till 2020, when ESD targets according to the current projections for 2019 and 2020 are planned to be met with existing national measures.

Table 4.1 Annual Latvia's ESD objectives, actual and projected volumes of GHG emissions in non-ETS, Mt CO_2 eq.

Year	2013[1]	2014[2]	2015[3]	2016[4]	2017[5]	2018[6]	2019[7]	2020[7]	*Total*
ESD target[8]	*9,260*	*9,351*	*9,442*	*9,534*	*9,729*	*9,817*	*9,904*	*9,992*	***77,030***
non-ETS emissions	*8,777*	*9,018*	*9,005*	*9,107*	*9,243*	*9,183*	*9,088*	*9,121*	***72,542***
ESD target fulfillment (surplus)	*+0,483*	*+0,334*	*+0,437*	*+0,426*	*+0,486*	*+0,634*	*+0,816*	*+0,871*	***+4,490***

[1] actual surplus in accordance with actual emissions approved by Commission Implementing Decision (EU) 2016/2132 of 5 December 2016 on greenhouse gas emissions for each Member State for the year 2013 covered by Decision No. 406/2009/EC of the European Parliament and of the Council;

[2] actual surplus in accordance with actual emissions approved by Commission Implementing Decision (EU) 2017/1015 of 15 June 2017 on greenhouse gas emissions covered by Decision No. 406/2009/EC of the European Parliament and of the Council for the year 2014 for each Member State;

[12] Regulation (EU) 2015/757 of the European Parliament and of the Council of 29 April 2015 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R0757

[3] actual surplus in accordance with actual emissions approved by Commission Implementing Decision (EU) 2017/2377 of 15 December 2017 on greenhouse gas emissions covered by Decision No. 406/2009/EC of the European Parliament and of the Council for the year 2015 for each Member State;

[4] actual surplus in accordance with actual emissions approved by Commission Implementing Decision (EU) 2017/2377 of 27 November 2018 on greenhouse gas emissions covered by Decision No. 406/2009/EC of the European Parliament and of the Council for the year 2016 for each Member State;

[5] actual surplus in accordance with actual emissions for the year 2017;

[6] according to the proxy GHG inventory of Latvia for 2018;

[7] according to the projections submitted to the Commission on 10 April 2019 in accordance with the report on policies, measures, projections drawn up in accordance with Regulation of the European Parliament and of the Council of 21 May 2013 525/2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No. 280/2004/EC;

[8] Latvia's annual ESD targets for the period from 2013 to 2020 are set by the European Commission's decisions: Commission Decision of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No. 406/2009/EC of the European Parliament and of the Council (2013/162/EU); Commission Decision (EU) 2017/1471 of 10 August 2017 amending Decision 2013/162/EU to revise Member States' annual emission allocations for the period from 2017 to 2020; Commission implementing decision 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No. 406/2009/EC of the European Parliament and of the Council (2013/634/EU).

Taking into account that Latvia has met its targets and has not transferred any ESD units to another EU Member State - Latvia used only one flexible mechanism (banking) under the ESD compliance cycles for the years 2013, 2014, 2015 and 2016 and transferred all the surplus of AEAs to 2017 ESD Compliance Account. In 2018 Latvia started to identify potential opportunities and partners regarding the trading of AEAs.

Assessment of the economic and social consequences of response measures

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

For the development of new policy initiatives through legislative proposals by the European Commission, an impact assessment system has been established in which all proposals are examined before any legislation is passed. It is based on an integrated approach which analyses both benefits and costs, and addresses all significant economic, social and environmental impacts of possible new initiatives (for details please refer to Chapter 15 of the Latvia`s National Inventory Report 2019).

Mitigation actions and their effects

Latvia has made efforts to improve the information on the effects of the policies and measures, however still for some individual measures Latvia has not been able to provide quantified estimates on the impacts on the national emissions. These measures are marked with NE (not estimated) in the CTF Table 3. There are various reasons why it has not been possible to make the estimates, such as the complexity and overlaps with other measures and where measurement of the effect is difficult (for example, measures providing advice and information). To avoid overlapping of estimates, the several individual measures are considered as the single package and thus the impact of the whole package is evaluated. This approach is applied for particular cases if such combination of measures is applicable and rational, e.g., the typical case of such package comprises the information measures and economic measures (investment support programmes). Regarding Energy sector, the evaluation by bottom-up method (the impact evaluation is done separately for each of measures or programmes) for the whole period of 2005-2015 shows that the evaluated mitigation measures, focused on GHG emissions decrease, had brought CO_2 emission reduction in 2016 by about 717 kt CO_2 eq. in total. The largest contribution (528 kt CO_2 eq.) in the GHG emission reduction had been provided due to fossil fuel switch

to RES. In its turn, energy efficiency measures had contributed 184 kt CO_2 eq. However, one should be cautious in applying the bottom-up method for impact evaluation, due to such measures as energy efficiency improvement in buildings and fossil fuel replacement by RES in heat supply usually interact and the overall impact of these interacting measures usually is less than the total impact obtained as the summed impacts of individual measures. To avoid both such overestimation and provide possibility to evaluate the impact of those types of policies and measures which cannot be evaluated by bottom-up method, e.g. fiscal policies, in Latvia's Energy (including Transport) sector the top-down evaluation method by applying MARKAL-Latvia model had been used. The top-down evaluation had shown that the mitigation policies and measures, implemented in the period 2005-2015, had brought in 2016 GHG emission reduction per about 1515 kt CO_2 eq. Namely, if such policies and measures would not be implemented, the GHG emissions in 2016 would be by 1515 kt CO_2 eq. higher compared to the actual emissions.

5. POLICIES AND MEASURES

The following section describes GHG emission reduction policies and measures. The full list of GHG PAMs is available in the Annex of the BR4, see CTF Table 3.

5.1. National climate policy planning

5.1.1. Policy planning strategies

The National Development Plan 2014–2020[13] is hierarchically the highest national-level medium-term planning document. NDP2020 is closely related to the Sustainable Development Strategy of Latvia until 2030 and the National Reform Programme for the Implementation of the EU2020 Strategy.

The goal of NDP2020 is to agree upon the most important medium-term priorities, areas of action, objectives and the indicators of their implementation.

The NDP 2020 ensures the sustainable use of the energy resources required by the national economy by promoting the availability of a market for the resources, a decrease of the energy intensity and emission intensity in certain sectors, and an increase of the proportion of renewable energy resources in the total consumption, while focusing on competitive energy prices. One of the measurable outcomes for the goal is Intensity of GHG emission in the economy (tCO_2 eq. per 1000LVL GDP) – 1.13 in 2020 and 1.07 in 2030.

National Reform Programme of Latvia for the Implementation of the "*Europe 2020*" Strategy (approved 26.04.2011[14]) defines that, according to the Effort Sharing Decision, GHG emission increase in Latvia non-ETS sector in total shall not increase +17% in year 2020, comparing to 2005. Total GHG emissions in Latvia, including both EU ETS and non-ETS sectors, accordingly the Programme, shall not increase in year 2020 by more than 12.19 million t CO_2 eq.

On 26 March 2014 Cabinet of Ministers adopted Latvia's **Environmental Policy Strategy 2014-2020**[15], replacing the previous one. The Strategy is the national level planning document for the environmental sector that includes directions for low-carbon policies development, low-carbon technology implementation and sustainable land management in farming. The general climate policy objectives under the section No.6 "Climate" are defined as follows: (1) to provide contribution of Latvia to prevention of global climate change by taking into account Latvia's environmental, social and economic interests, and (2) to promote Latvia's preparedness for adaptation to climate change and its impacts.

The following policies and measures are defined by the Environmental Policy Strategy 2014-2020 as the most important:

1. implementation of GHG emissions' reduction measures in all sectors of economy, alongside with promoting sustainable, low carbon capacity and cost-effective development;

[13] Latvia's The National Development Plan 2014–2020, http://www.pkc.gov.lv/sites/default/files/images-legacy/NAP2020%20dokumenti/NDP2020_English_Final.pdf

[14] Latvia's National Reform Programme of Latvia for the Implementation of the "Europe 2020" Strategy, the Cabinet of Ministers, 26 April 2011, https://rio.jrc.ec.europa.eu/en/library/national-reform-programme-latvia-implementation-europe-2020-strategy

[15] Environmental Policy Strategy 2014-2020 (Vides Politikas Pamatnostādnes 2014-2020.gadam), the Cabinet of Ministers, 26 March 2014, http://www.varam.gov.lv/lat/pol/ppd/vide/?doc=17913

2. integration of the climate policy targets in the policy of other sectors by setting the responsibilities of each sector and promoting cooperation between the state, local governments and the private sector;
3. raising public awareness about climate change and adaptation to climate change as well as involving people in the policy development and its implementation;
4. implementation of effective adaptation measures and their integration in the spatial planning and sector policies.

In order to measure settled policies and measures the following targets have been defined:

- Limited or stabilised total GHG emissions – 12.16 ($MtCO_2$ eq.) in 2020;
- Limited or stabilised non-ETS GHG emissions – 9.9 ($MtCO_2$ eq.) in 2020;
- Reduced ETS GHG emissions – 2.26 ($MtCO_2$ eq.) in 2020;
- GHG intensity of national economy (tCO_2 eq. per 1000LVL GDP) – 1.13 in 2020; 1.07 in 2030;
- Ensured CO_2 removals target in forestry – 4.60 ($MtCO_2$ eq.) in 2020 (for every year in 2013-2020, according to technical corrections).

To reach the quantitative targets above, the Environmental Policy Strategy 2014-2020 sets the following concrete activities:

1. ensure implementation of ETS activities (responsible ministry – MEPRD);
2. prepare the planning document for low carbon development (responsible ministry – MEPRD);
3. promote sustainable use of biomass for energy production by applying low carbon emitting technologies (responsible ministry – MoE, involved – MoA and MEPRD);
4. promote ensuring the supply of economically and ecologically sustainable biomass (responsible ministry – MoA);
5. promote energy efficiency in buildings (responsible ministry – MoE, involved – MEPRD, local governments);
6. increase the efficiency of lighting infrastructure (responsible ministry – MEPRD, involved – local governments);
7. promote ensuring of CO_2 removals in forest lands (responsible ministry – MoA, involved – MEPRD);
8. promote carbon removal in wood products with long useful lifetime (responsible ministries – MoA, MoE);
9. introduce low carbon emitting technologies and sustainable farming practices in agriculture (responsible ministry – MoA);
10. integrate climate related aspects in the transport policy at national and local level (responsible ministry – MoT, involved – local governments);
11. develop environmentally friendly transport infrastructure and promote the use of renewable energy resources in public transport (responsible ministry – MoT, involved – MoE, MEPRD, local governments);
12. prepare and implement the plan for promoting Green Public Procurement (responsible ministry – MEPRD);
13. develop research in the fields of climate change and adaptation in the frame of EEA instruments (responsible ministries – MEPRD, MoA, involved – MoE, the Ministry of Education and Science);

14. promote the use of renewable energy resources and energy efficiency in district heating (responsible ministry – MoE);
15. develop Green Technologies Incubator (responsible ministry – MoE);
16. prepare and implement climate change action plan (responsible ministry – MEPRD, involved – MoE, MoA, MoT).

5.1.2. Participation in the flexible mechanisms of the Kyoto protocol

Latvia as a Party to the Kyoto Protocol has a possibility to participate in the flexible mechanisms provided for in the Protocol. In years 2009-2013 in case of Latvia especially important was the international emissions trading mechanism, in which Latvia had acted as a seller. Government of Latvia ensured that every AAU sold was used for "greening" purposes which means climate change mitigation, promotion of low carbon economy development by application of innovative environmental technologies, increase of RES use and improvement of energy efficiency as well as capacity building for climate change policy design and implementation. Revenues obtained from the sale of GHG emissions allowances (national CCFI) were directed by open tenders in years 2010-2015 to investment projects' assistance focused on reduction of CO_2 emissions by improving energy efficiency and use of RES (see the description of the particular measures below). Important, the special "soft" programs were focused on general public and stakeholders' capacity building, promotion of public understanding on the importance and possibilities of GHG emissions' reduction as well as on supporting R&D, innovative environmentally friendly energy technologies pilot projects. In total, the funds of CCFI used for co-financing the projects constituted ~204 MEUR, thus CCFI had an important role for providing green investments in Latvia. As currently these measures have been expired, they are included as the "*Expired Measures which have an effect, or is expected to continue to have an effect on GHG emissions*".

5.1.3. Auctioning of Emission Allowances

After the closure of CCFI a new financial instrument called the Emission Allowances Auctioning Instrument has been established in 2016. In October, 2016, the MEPRD has published the Strategy for the Use of Emissions Allowances Auctioning Instrument[16] and it has been updated in 2019. The EAAI is aimed at tackling climate change, supporting adaptation to the impacts of climate change and reducing GHG emissions in accordance with national legislation. EAAI is funded directly from revenues of auctioning of emission allowances. From November 2012, when the first auction of EU ETS 3rd period allowances began, till the end of 2018, Latvia has auctioned nearly 14 million emission allowances in the primary market on the common auctioning platform and gained 106.02 MEUR from these auctions. In addition to the auctions in the primary market, in 2018 Latvia auctioned 3.13 million allowances in the secondary market resulting in total revenues of 60.66 MEUR, which is a significant complement to the EAAI funding. These emission allowances was the result of proceedings in the General Court of the European Union (Case T-369/07 Latvia versus European Commission), which were subsequently

[16] Strategy for the Use of Emissions Allowances Auctioning Instrument, MERPD, Order No.265, 21 October 2016, http://www.varam.gov.lv/in_site/tools/download.php?file=files/text/Finansu_instrumenti/EKII/Normativie%20akti//EKII_strategija_21_10_2016_final.pdf

converted to EU ETS 3rd period allowances. Four open tenders for projects had been organized from 2016 till 2018 with total available EAAI co-funding in amount of 50 MEUR.

5.1.4. Participation in European Economic Area Financial Mechanism 2009-2014

Programme "National Climate Policy"[17]

The objective of the Programme was to support Latvia in developing a comprehensive national climate policy covering non-ETS sector as regards emissions, and all sectors as regards adaptation. Within Programme the Latvian institutional capacity in national climate policy development and implementation was strengthened, including information analyses, scenario development, society involvement, policy analyses and development of documents for integrated climate change mitigation and adaptation to climate change management. Related to climate change mitigation the Programme included both (i) pre-defined project "Development of the National System for GHG Inventory and Evaluation and Reporting on Policies, Measures and Projections", and (ii) open calls. The projects implemented within open calls promoted public understanding and research on climate change mitigation as well as had high demonstration value of low-energy building. As currently these measures are expired, they are included as the "*Expired Measures which have an effect, or is expected to continue to have an effect on GHG emissions*".

5.1.5. Low-Carbon Development Strategy

In August 2018 the first draft of "National Strategy for Low Carbon Development until 2050" was published. The first draft included a target of 80% GHG emissions reduction by 2050 compared to 1990. Taking into account the best available science, such as "IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty", European Commission's Communication "A Clean Planet for all! A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy", which outlines a vision of the deep economic and societal transformations required, engaging all sectors of the economy and society, to achieve the transition to a climate-neutral economy, the Ministry of Environmental Protection and Regional Development has prepared a new version of "National Strategy for Low Carbon Development until 2050" proposing much more ambitious GHG reduction target that would be in line with the goals of the Paris Agreement to keep temperature increase to well below 2°C, and pursue efforts to keep it to 1.5°C. To be fully consistent with the EU's ambition to lead the world towards climate neutrality, inter-ministerial coordination is currently on-going on setting the goal for Latvia achieving climate neutrality by 2050. Currently, it is expected that the "National Strategy for Low Carbon Development until 2050" will be adopted by the end of 2019.

[17] Programme "National Climate Policy",
http://www.varam.gov.lv/eng/fondi/EEA_Norv/european_economic_area_financial_mechanism_programme__national_climate_policy

5.2. Energy

5.2.1. Regulatory policies and measures

Increasing a deployment of renewable energy sources

Pursuant to Annex I(A) to the *Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources* (*RES Directive*), Latvia's target is to increase the use of RES from 32.6% of gross final energy consumption in 2005 up to 40% in 2020.

The **Electricity Market Law** (2005, transposition of the *RES Directive 2009/28/EC* by the Amendments of 08 July 2011[18]) has the following purposes: (i) to promote the production of electricity by using RES; (ii) to establish prerequisites for the operation of an efficiently functioning electricity market; (iii) to ensure that all energy customers are provided with electricity in a safe and qualitative manner, in the most efficient possible way for justified prices; (iv) to ensure all customers with the right to choose an electricity trader freely; (v) to promote energy independence ensuring different suppliers of energy resources necessary for production of electricity.

The measures based on the Electricity Market Law are included in the WEM scenario. Regarding preferential feed-in tariffs, in Latvia the application of them had started in 1996 as the national policy (thereafter the principles of determining and calculation of FIT had been changed several times), afterwards this policy had been linked with EU RES policies. However, from 2011 the new RES electricity and CHP electricity producers have no rights to qualify for the FIT. Thus, for the time being the preferential FIT are continuing in relation to the existing RES plants and CHP units till the end of expire of these rights. Taking into account the course of Latvia RES support policy, the WEM scenario envisages that complex measures to further develop electricity market and to decrease FIT support for RES and CHP producers are implemented.

The calculated CO_2 emissions reduction in 2030 is 200 kt. Taking into account that such support is not available from 2016 for the new RES plants, the impact of the given policy in year 2030 is less than in year 2020.

Increasing the energy efficiency

The Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency (*Energy Efficiency Directive)* establishes a common framework of measures for the promotion of energy efficiency within the Union in order to ensure the achievement of the Union's 2020 20% headline target on energy efficiency and to pave the way for further energy efficiency improvements beyond that date.

The Latvia's **Energy Policy Strategy 2016-2020[19]** defines the following indicators in year 2020 in compliance with *Energy Efficiency Directive 2012/27/EU*:

- total savings of primary energy resources in year 2020 – 0.670 Mtoe[20];

[18] Electricity Market Law, 5 May 2005, http://likumi.lv/doc.php?id=108834

[19] Latvia's "Energy Policy Strategy 2016-2020" (*Enerģētikas Attīstības Pamatnostādnes 2016.–2020.gadam*"), the Cabinet of Ministers, 9 February 2016, http://likumi.lv/ta/id/280236

[20] This indicative primary energy target 2020 is defined according to the requirements of the Article 3 of the Energy Efficiency Directive.

- total cumulative energy savings – 0.85 Mtoe (9896 GWh)[21];
- renovation of central state administration buildings – 3% of total area annually until year 2020.

Latvia is using both options **- Energy Efficiency Obligation Scheme[22]** and **Alternative Policy Measures[23]** to meet total cumulative energy savings**.** The **Energy Efficiency Law[24]** which contains legal norms arising from the *Energy Efficiency Directive 2012/27/EU* are in force from 29 March 2016. The measures based on the Energy Efficiency Law are included in the WEM scenario. Among others, Energy Efficiency Law provides the framework for the EEOS and for such measures as energy audits and energy efficiency improvement in large enterprises (the transposition of the framework defined by the Energy Efficiency Directive), energy management systems in enterprises which are large electricity consumers (national measure), energy management systems in central state administration institutions and municipalities, as well as voluntary agreements on energy efficiency with commercial sector and with other actors.

Energy Management Systems in Large Enterprises. Large enterprises and large electricity consumers[25] shall provide annual report on implemented energy saving measures and energy savings obtained. At least three energy efficiency measures which have the highest energy savings or the highest economical return shall be implemented both by large enterprises (up to the 1 April 2020) and by large electricity consumers (up to the 1 April 2022). The measure is included in the WEM scenario.

Energy Management Systems in Public Authorities. The EMS shall be mandatory implemented in those central state administration institutions which have buildings with total heating area 10000 m^2 and above. In its turn, mandatory implementation of EMS in Latvia municipalities is stated for: (i) largest nine cities and (ii) those municipalities which have population above 10000 inhabitants in case the territorial development index of the municipality reaches or is above the defined threshold value (10 municipalities in 2018), other municipalities may introduce EMS voluntary. Annual report on implemented energy efficiency measures and obtained energy savings shall be submitted. The measure is included in the WEM scenario.

The **recast Law on the Energy Performance of Buildings,** adopted in December 2012[26] in accordance with the requirements of *the Directive 2010/31/EC of the European Parliament and of the Council of 19 May on the energy performance of buildings* (*EPB Directive*) recasts the general legal framework of setting the mandatory minimum energy performance requirements for buildings, recasts the general principles of mandatory energy efficiency certification of buildings, verification of buildings heating and ventilation systems, etc. The measures based on the Law is included in the WEM scenario.

[21]Article 7 of the Energy Efficiency Directive states the amount of cumulative end-use energy savings to be achieved by Member states. In the period 2014-2020 these savings shall be at least equivalent to new savings each year of 1.5% of annual energy sales to final customers by volume, averaged over the most recent three-year period prior to 1 January 2013. Member states may use Energy Efficiency Obligation Scheme and/or Alternative Policy Measures to meet this target.

[22]"Regulations on Energy Efficiency Obligation Scheme", Cabinet of Ministers Regulation No. 226, 19 May 2017. According the Regulation (Article 2), the obliged parties for the EEOS start sub-period and the first sub-period (up to 31 December 2020) are electricity retail sellers which had sold at least 10 GWh of electricity in 2016, or in any of years related to EEOS sub-period, https://likumi.lv/ta/id/290809.

[23] Latvia National Plan of the Alternative Measures of Energy Efficiency Policy to Reach the Target of Energy End-Use Consumption Saving 2014-2020 (*Energoefektivitātes politikas alternatīvo pasākumu plāns enerģijas galapatēriņa ietaupījuma mērķa 2014.–2020.gadam sasniegšana),* Cabinet of Ministers Regulation No. 257, 24 May 2017, http://polsis.mk.gov.lv/documents/5921

[24]Energy Efficiency Law, 5 May 2005, http://likumi.lv/doc.php?id=280932

[25]The enterprise is considered as a large electricity consumer if its own annual electricity consumption is above 500 MWh

[26]Law on the Energy Performance of Buildings, 6 December 2012, http://likumi.lv/doc.php?id=253635

Energy certification of buildings. The Cabinet of Ministers Regulation No.383 (2013)[27] introduces six (A-F) energy efficiency classes for residential and non-residential buildings. The Regulation states energy performance indicator values for nearly zero energy building; permissible level of EPI values for the buildings to be reconstructed or renovated; the EPI value, exceeding of what the building needs energy performance measures:

- nearly zero energy building is defined having EPI for heating not higher 40 kWh per m^2 per year (residential) or 45 kWh per m^2 per year (non-residential) and 95 kWh per m^2 per year EPI for total energy consumption. New buildings of state administration institutions shall correspond to nearly zero energy buildings starting from 01.01.2019 and hereinafter, new residential buildings and other non-residential buildings – from 01.01.2021 (if the minimum permissible EPI level is technically or functionally possible and benefit analysis on the useful lifetime of the relevant building does not indicate to losses), transition values tor nearly zero energy buildings for each year in the 2016-2021 period are stated;
- in case of class F-EPI for heating exceeds 150 kWh per m^2 per year - the building needs energy performance improvement measures;
- minimum permissible levels of EPI for the buildings to be reconstructed or renovated up to 31.12.2020 are: ≤ 90 kWh per m^2 per year (multi-apartment building), ≤ 100 kWh per m^2 per year (one- and two-apartment building), ≤ 110 kWh per m^2 per year (non-residential building). From 01 January 2021 these values are strengthened by the Latvian Construction Standard "Thermotechnics of Building Envelopes": respectively ≤80 kWh per m^2 per year (multi-apartment building), ≤ 90 kWh per m^2 per year (one- and two-apartment building and public authority building), ≤ 110 kWh per m^2 per year (other non-residential building).

The measure is included in the WEM scenario.

Minimum thermal insulation standards. Actual (in force) national Latvian Construction Standard LBN 002-15 "Thermotechnics of Building Envelopes"[28] transposes the requirements of the *recast Directive 2010/31/EU on Energy Performance of Buildings*; the standard is based on fulfilment of normative and maximums values of heat transmittance coefficients for the construction elements and the linear thermal bridge. The measure is included in the WEM scenario.

Energy Efficiency Requirements for District Heating Systems. The Cabinet of Ministers Regulation[29] No. 243 (2016) defines the following minimum energy efficiency requirements for DH technologies: (1) heat production boilers (respectively, 92% - gaseous fuel, 85% - liquid fuel, 75% - solid fuel), (2) combined heat-power production units (respectively, 80% - gaseous and liquid fuels, 75% - solid fuels), (3) solar heat collectors (respectively, 70% - vacuum tube collectors, 75% flat plate collectors), (4) heat pumps (shall correspond at least class "C"), (5) annual maximum heat losses in DH pipeline network (from 01.01.2018 – not higher than 19%, from 01.01.2019 – not higher than 17%). The measure is included in the WEM scenario.

[27] Regulations Regarding Energy Certification of Buildings, Cabinet of Ministers Regulation No. 383, 9 July 2013, http://likumi.lv/doc.php?id=258322 issued pursuant to the Law on the Energy Performance of Buildings

[28] Latvian Construction Standard LBN002-15 "Thermotechnics of Building Envelopes" (Latvijas būvnormatīvs LBN 002-15 "Ēku norobežojoši konstrukciju siltumtehnika), Cabinet of Ministers Regulation No. 339, 30 June 2015, http://likumi.lv/ta/id/275015

[29] Regulations Regarding the Energy Efficiency Requirements for District Heating Systems in the Possession of a Licensed or Registered Energy Supply Merchant and the Procedures for the Conformity Examination Thereof, Cabinet of Ministers Regulation No. 243, 19 April 2016, http://www.likumi.lv/doc.php?id=281914

Mandatory individual heat energy metering. 3 November 2015 the Amendments to the *Cabinet of Ministers Regulation No.876 On Heat Energy Supply and Consumption*[30] have been adopted which transposed the requirements of the *Energy Efficiency Directive 2012/27/EU*. The noted Amendments provide for the installation of meters or heat cost allocators in multi-apartment and multi-purpose buildings that share the bill for the heat energy consumed, with a view to recording the amounts of heat energy consumed for heating purposes in each apartment or set of premises that is invoiced separately. Thus energy savings due to better information of end-users are promoted. These provisions are in force from 31 December 2016 and apply to new buildings and buildings to be converted or renovated (if funded by EU funds, State or municipal budgets) for which a building permit has been issued after 1 January 2016 and to which heating is supplied from a common heat source or a district heating system. The measure is included in the WEM scenario.

5.2.2. Economic policies and measures

Programme for District Heating Systems

In **EU Funds planning period of 2014-2020** the co-financing of investment is provided by Cohesion Fund within the framework of the national *Operational Programme "Growth and Employment"*, Thematic Objective No.4 *"Supporting the shift towards a low-carbon economy in all sectors"*, the Specific Objective 4.3.1. *"To promote energy efficiency and use of local RES in district heating systems"*. The total amount of CF support is planned 60 MEUR[31]. The measure is included in the WEM scenario.

The total GHG emissions saving of this measure and the noted above measure (Energy Efficiency Requirements for District Heating Systems) constitutes 76 kt CO_2 in 2030.

Programmes for Household sector

In **EU Funds planning period of 2014-2020** increasing of energy efficiency in multi-apartment buildings is co-financed within the framework of the national *Operational Programme "Growth and Employment"*, Specific Objective 4.2.1.1 *"To increase energy efficiency in residential buildings"*. Planned total amount of public financial support for the implementation of the measure is up to 166.5 MEUR, of which (i) ERDF financing – 141.5 MEUR, and (ii) state budget financing - 25 MEUR[32]. The financial assistance is provided in the following forms: (1) subsidy (grant), including consultancies and overall programme management – up to 134.5 MEUR, (2) repayable low-interest loan, (3) guarantee for the loan, the latest two instruments in total up to 32 MEUR. The measure is included in the WEM scenario.

The given measure in combination with the described above supporting informative and regulatory measures in building sector provides 40 kt CO_2 emission reduction.

[30] Amendments to the Cabinet of Ministers Regulations No. 876 (2008) "Heat Energy Supply and Consumption Regulations", Cabinet of Ministers Regulations No. 628, 3 November 2015, http://likumi.lv/doc.php?id=277661

[31] Hereinafter for the EU Funds 2014-2020 planning period the financial data are taken from the EU Funds Implementation Progress: monthly report June 2019, http://www.esfondi.lv/finansu-un-raditaju-plani-to-izpilde (if another source is not indicated).

[32] Cabinet of Ministers Regulation No. 160 (15.03.2016) regarding implementation of the 4.2.1.1. specific objective "Energy Efficiency Measures in Residential Buildings" of the Specific Objective No.4.2.1 "To increase energy efficiency in public and residential buildings" of the Operational Programme "Growth and Employment", Article 9, https://likumi.lv/ta/id/281323

It is planned (the final draft of national Energy-Climate Plan 2021-2030[33]) that in **EU Funds planning period of 2021-2027** the co-financing for apartment buildings energy efficient renovation will be continued. Thus, this measure of continuation is included in the WAM scenario.

Programmes for Industrial Buildings and Technologies

Efficient use of energy resources, reduction of energy consumption and transfer to RES in manufacturing industry: EU Funds planning period of 2014-2020. Development of new, innovative energy-saving technology, measures increasing energy efficiency and share of RES is manufacturing industry (corresponding to the part C of NACE 2 version, except C12 – tobacco production) is co-financed within the framework of the national *Operational Programme "Growth and Employment"*, the Specific Objective 4.1.1. *"To promote efficient use of energy resources and reduction in energy consumption in the manufacturing industry sector"*. The target group are both small (micro), small, medium and large enterprises. Planned total amount of financial support by Cohesion Fund ~25.75 MEUR[34]. The measure is included in the WEM scenario.

Investments Support Programme to Improve Energy Efficiency in Food Processing Enterprises: EU Funds planning period of 2014-2020. The co-financing is provided within the framework of the Measure 04.2 *"Investments"* of the national *Rural Development Programme 2014-2020* financially supported by *European Agriculture Fund for Rural Development*. The total planned amount of investment support constitute ~80 MEUR, of which ~11.4 MEUR is directly planned to co-finance improvement of energy efficiency of food processing enterprises and agriculture sector in general[35]. Other investments may bring energy efficiency improvements indirectly as well. The support might be used also for implementation of RES technologies in the enterprise. The measure is included in the WEM scenario.

Programmes for Public Sector

Increasing Energy Efficiency in Public Sector Buildings: EU Funds planning period 2014-2020. Increasing of energy efficiency in public buildings is supported within the framework of the national *Operational Programme "Growth and Employment".* The following measures are included in the WEM scenario:

- public buildings of local governments - the Programme's Specific Objective 4.2.2. *"To facilitate the increase of energy efficiency in municipal buildings, according to the integrated development programme of the municipality",* the total planned financing for the given programme is at least ~55.3 MEUR, of which ERDF co-financing ~47 MEUR and state budget subsidies & municipal budgets at least ~8.3 MEUR[36];
- public buildings of state (central government) – the Programme's Specific Objective 4.2.1.2 *"To increase energy efficiency in state buildings"*, the total public financing for the given programme

[33] Latvia national Energy-Climate Plan 2021-2030. Project Final Version submitted to EC, viewed by the Cabinet of Ministers, 18 December 2018) https://em.gov.lv/lv/nozares_politika/nacionalais_energetikas_un_klimata_plans/

[34] Cabinet of Ministers Regulations regarding the implementation of the measure: https://likumi.lv/ta/id/284596, https://likumi.lv/ta/id/296683

[35] Latvia national Rural Development Programme, p.155, https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/01/50/34/Programme_7.pdf

[36] Cabinet of Ministers Regulation No. 152 (24.03.2016) regarding the implementation of the 4.2.2. Specific Objective "To Facilitate the Increase of Energy Efficiency and Utilisation of Renewable Sources in Municipal Buildings, According to the Integrated Development Programmes of Municipalities" of the Operational Programme "Growth and Employment", http://likumi.lv/doc.php?id=281111

is planned ~115.13 MEUR, of which ~97.86 MEUR provided by the ERDF and the rest by the state budget. At least 30% of heat energy (or heat energy plus electricity) savings should be reached in the building as a result of the implementation of the project[37].

Investment Support Programmes to reduce GHG emissions: national Emissions Allowances Auctioning Instrument. The revenues due to the auctioning of Latvia's allocated EU ETS emission allowances are used for co-financing the energy efficiency measures which have high demonstration value. Currently several EAAI programmes are under implementation focused to nearly zero energy public buildings (new building as well as reconstruction of existing ones) comprising smart technologies as well as use of smart technologies for energy efficiency (e.g., efficient outdoor lightning) in urban environment. Up to now ~50 MEUR of EAAI financing are allocated for these programmes[38]. The measure is included in the WEM scenario.

It is planned (the final draft of the national Energy-Climate Plan 2021-2030) that in **EU Funds planning period of 2021-2027** the particular support programme for **state administration buildings** energy efficiency improvement will be continued. Thus, this measure of continuation is included in the WAM scenario.

Programmes to Promote Production of Renewable Energy in Agriculture sector

In EU Funds planning period of 2014-2020 the co-financing is provided by national Rural Development Programme under the Priority 5C (the particular measure "Investment support in rural farms") to promote the production of renewable energy. The total amount of public allocations for renewable energy production investments is planned 16 MEUR[39]. The measure is included in the WEM scenario.

5.2.3. Fiscal policies and measures

The following measures – fuel taxation and taxation applicable for electricity – are included in the WEM scenario.

Fuel taxation[40]

Currently the **natural gas** is dominating fossil fuel in the stationary combustion sources in Latvia.
Articles 6^1& 15^1 of the **Law "On Excise Duties"[41]** determine the rates of duty for natural gas utilised for energy production:

- the general rate is 1.65 EUR per MWh (the highest calorific value).
- the reduced (33% or 0.55 EUR per MWh) rate is applied for natural gas utilised as fuel for industrial production processes as well as other processes related to production, and for providing necessary climate conditions in production premises.
- the exemption is applied for natural gas utilised in agriculture sector for providing heat for greenhouses, industrial scale henhouses/sheds and incubators.

[37]Cabinet of Ministers Regulations regarding the implementation of 4.2.1.2 Soecific Objective "Increase of Energy Efficiency in State Buildings": https://likumi.lv/ta/id/284333 and https://likumi.lv/ta/id/296336
[38]The 2018 Report on the Use of EAAI, p.5., Ministry of Environmental Protection and Regional Development http://varam.gov.lv/lat/fondi/ekii/likumdosana/
[39]Latvia national Rural Development Programme, p.155
https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/01/50/34/Programme_7.pdf
[40]For transport fuel taxation see below, in Transport chapter
[41]Law "On Excise Duties", 30 October 2003, http://likumi.lv/doc.php?id=81066

- the exemption is stated also for: (i) natural gas utilised for other purposes (not as fuel or transport fuel) or utilised in two ways (including processes of chemical reduction, electrolytic and metallurgy processes), (ii) amount of natural gas used by the operator of natural gas transmission, storage and distribution system for the technological needs of natural gas supply (including losses during supply), (iii) natural gas utilised in mineralogy processes.

Articles 5&14 of the *Law "On Excise Duties"* determine the rates of duty for **mineral oils** and their substitutes utilised for energy production. The actual rates are: (i) residual fuel oil – 15.65 EUR/ton, (2) kerosene, diesel (gas oil) – 56.91 EUR/ton. The exempt is made for the oil products utilised for electricity production and for production in CHP mode. The oil gasses and other hydrocarbons if they are supplied to persons who use them as heating fuel or in gas furnaces and other equipment (not as the transport fuel) is exempted from the duty as well.

The procedure of taxation applicable for coal**,** coke and lignite is prescribed by the *Natural Resources Tax Law*[42]. The actual rate (from 01.01.2019) is 0.38 EUR/GJ or 10.65 EUR/ton if information of specific heating value of coal is not available. The exemption is stated for coal utilised for electricity production and in CHP mode.

Taxation applicable for electricity

The procedure is prescribed by the **Electricity Tax Law**[43]**.** The actual rate is 1.01 EUR/MWh. Electricity supplied to an end user, as well as electricity, which is supplied for own consumption, shall be taxable, except for the cases specified in the Law. Tax shall apply to entities who are engaged in the generation, distribution, supply, selling of electricity as well as purchasing electricity in electricity spot exchange. The actual exemptions are stated for: (i) household users, (ii) street lighting services, (iii) the exemption is made also for autonomous producers if they correspond to certain criteria[44].

5.2.4. Information and Education policies and measures

Informing Energy Consumers of Residential Sector (Multi-apartment buildings). The measure motivates to renovate multi-apartment buildings to increase their energy efficiency in the frame of the ERDF supported activity, described above. Wide scope of methods are applied by the informative programme *"Let's live warmer!'*[45] to reach target groups. The information programme informs and consults societies of the flats' owners regarding conditions and benefits of energy efficiency increase, encourages building companies, building materials producers and traders to take initiatives regarding energy efficient renovation of multi-apartment buildings as well as raises overall understanding on energy efficiency. The measure is included in the WEM scenario.

Energy Audits of Residential Multi-apartment buildings. The objective of the measure is more efficient use of final energy, reducing energy loss and emissions by providing recommendations for increasing energy efficiency. Currently, in EU Funds planning period of 2014-2020, the support for preparation of technical documentation related to buildings' energy efficient renovation is stated as the eligible cost

[42] Natural Resources Tax Law, 15 December 2005, https://likumi.lv/doc.php?id=124707
[43] Electricity Tax Law, 19 Decmeber 2006, http://www.likumi.lv/doc.php?id=150692
[44] The exemption is done for the autonomous producers, who generate and consume electricity for their own needs and fulfil the following requirements: the total generation capacity does not exceed 2 MW, and energy resources taxable with excise duty, coal taxable with the nature resource tax or electricity taxable with the electricity tax is used for the generation of the electricity.
[45] "Let`s live warmer" https://www.em.gov.lv/lv/es_fondi/dzivo_siltak/

for multi-apartment building renovation co-financed by the ERDF. Also a number of municipalities provide this support according issued municipal by-laws. The measure is included in the WEM scenario.

Labelling. The legislative framework for the harmonised national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during products' use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products has been established in Latvia by the transposition of the requirements of the *Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for setting eco-design requirements for energy related products* (*Ecodesign Directive)*[46] and of the *Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products*[47] *(*repealed 31 July 2017, due to the *Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU has come into force*). The requirements stated by the respective EC Delegated Regulations are implemented directly. The measure is included in the WEM scenario.

5.2.5. Voluntary negotiated measures

The actual conditions to co-operate with the business sector and other actors are established by the Cabinet of Ministers Regulation No.669 (2016) "Procedure for Entering into and Supervision of Energy Efficiency Improvement Agreements"[48]. The agreement shall have the target – at least 10% of energy efficiency improvement and shall be entered into for a time period of not shorter than five years. The achievement of the energy savings target shall be justified by the energy efficiency action plan. The measure is included in the WEM scenario.

5.2.6. Expired Measures which have an effect, or is expected to continue to have an effect on greenhouse gas emissions

Programmes of EU Funds planning period of 2007-2013

- Programme for District Heating Systems had co-financed (Cohesion Fund) heat supply efficiency improvements in DH systems pipeline networks, development of effective biomass utilising heat production units as well as development of solid biomass utilising CHP units (implementation finished 2015);
- Programme for Energy Efficiency in Residential Buildings) had co-financed (EU Regional Development Fund) the investments in energy efficient multi-apartment building renovation (implementation finished 2016);

[46]Regulations regarding Ecodesign Requirements for Energy-Related Products, Cabinet of Ministers Regulation No. 941, 6 December 2011, http://likumi.lv/doc.php?id=241282

[47]Regulations regarding Labelling of Energy and Other Resources Consumption Related Products as well as Their Advertisment and Supervision, Cabinet of Ministers Regulation No. 480, 21 June 2011, http://likumi.lv/doc.php?id=232553

[48]Procedure for Entering into and Supervision of Energy Efficiency Improvement Agreements, Cabinet of Ministers Regulation No. 669, 11 December 2016, http://likumi.lv/ta/id/285879

- The co-financing for biogas production and its use for energy (electricity) production had been provided for the agriculture sector business entities & service co-operatives by national *Rural Development Programme*, co-financed by EAFRD (implementation finished 2015).

National green investment scheme: Climate Change Financial Instrument:

- Programme for Renewable Energy Technologies in Households had provided co-financing in years 2011-2012 for micro-generation technologies (solar heat & PV, wind, solid biomass, heat pumps as well as combined use of them);
- co-financing for Industrial Buildings and Technologies Energy Efficiency to Reduce GHG emissions had been implemented in the period 2010-2015 (several programmes);
- co-financing for Public Sector Energy Efficiency had been implemented in the period 2010-2015 (several programmes);
- Programme for Renewable Technologies for Heat and Electricity Production to Reduce GHG emissions had provided, in 2010-2012, co-financing for installation of RES technologies of different type for both heat, electricity and CHP production (the capacity of one RES unit - up to 3 MW) in both public sector and business sector.

5.3. Transport

5.3.1. Regulatory policies and measures

Biofuel Mix Obligation Requirement

To ensure growth of the share of RES in the Transport sector, in 01.10.2009 Latvia had introduced the Biofuel Mix Obligation Requirement[49]. Actual provisions are: (1) Bioethanol mix, 4.5-5% (volume) of total volume, is mandatory for the gasoline of "95" trademark. (2) For mandatory biodiesel mix two options are stated: (a) 4.5-7% (volume) of total volume, if the biodiesel, produced from rapeseed oil, is mixed, (b) at least 4.5% (volume) of total volume, if the paraffinic diesel, produced from biomass, is mixed. The exemption from biodiesel mix obligation is stated for diesels utilised in winter climate conditions.

Mandatory annual systematic inspection of technical conditions of motor vehicles

Mandatory annual technical inspections of motor vehicles ensure that only those vehicles that comply with technical and environmental requirements are being allowed to take part in road transport[50].

Public Procurement: Promotion of clean and energy efficient road transport

The description of this PAM see below in the Cross-Sectorial sector, in the PAM “Green Public Procurement”.

[49] Requirements for Conformity Assessment of Petrol and Diese Fuel, Cabinet of Ministers Regulation No. 332, 26 September 2000, https://likumi.lv/ta/id/11217

[50] Regulations on motor vehicles state technical inspection and technical roadside inspection, Cabinet of Ministers Regulation No. 295, 30 May 2017, https://likumi.lv/doc.php?id=292396

5.3.2. Economic policies and measures

Electric Vehicles Charging Infrastructure Development: EU Funds Planning Period of 2014-2020. In April 2017 the Alternative Fuels Development Plan 2017-2020[51] had been approved, which includes EV charging infrastructure development as one of the measures. Development of EV charging infrastructure is supported within the framework of the national *Operational Programme "Growth and Employment*", Thematic Objective No.4 "*Supporting the shift towards a low-carbon economy in all sectors*", the Specific Objective 4.4.1. As a result single national level fast charging infrastructure coverage (150 EV charging points - direct current fast charging points with capacity at least 50 kW) is ensured which promotes the development of EV market and increase of EVs in road transport. Planned total amount of financial support – 8.344 MEUR, of which ERDF support – 7.092 MEUR, state budget – 1.252 MEUR[52]. Thus, the investments are contributing in the fulfilment of requirements foreseen in the *Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure.* The measure is included in the WEM scenario.

Development the infrastructure of environmentally friendly public transport: EU Funds planning Period of 2014-2020. The development of the infrastructure of public transport is co-financed by Cohesion Fund within the framework of the national *Operational Programme "Growth and Employment"*, the Specific Objective 4.5.1. The use of PT is promoted by increase of number of environmentally friendly vehicles of PT (trams and buses) and length of tram lines. Thus, more effective urban transport infrastructure will be developed resulting that the flow of passengers will direct from private transport to PT, decreasing the flow of road transport in cities, and emissions will be reduced. Investments are made in accordance with city development plans. The measure is included in the WEM scenario.

Alternative Fuels Infrastructure Development. In April 2017 the Alternative Fuels Development Plan 2017-2020 had been approved. The Plan foresees for the development of LNG, CNG, hydrogen infrastructure (in addition to EV infrastructure described above. Specific infrastructure development plans are envisaged. The measure is included in the WEM scenario.

5.3.3. Fiscal policies and measures

Excise Tax in Transport sector. Law "On Excise Duties" establishes procedure by which duty shall be imposed. The Art. 5, 14 and 18 determine the rates of duty for gasoline and diesel oil. The Art. 6^1&15^1 determine the rate for natural gas (Table 5.1). The measure is included in the WEM scenario.

[51]Alternative Fuels Development Plan 2017-2020, Cabinet of Ministers Ordinance No. 202, 25 April 2017, http://polsis.mk.gov.lv/documents/5893

[52]Cabinet of Ministers Regulation No. 637 (03.11.2015) regarding the 4.4.1. Specific Objective "To Develop the Electric Vehicles' Charging Infrastructure of in Latvia" implementation, https://likumi.lv/doc.php?id=277693

Table 5.1 The 2018-2019 and from 1 January 2020 duties for fuels used in Transport sector

	Duties, EUR per 1000 litres	
	2018-2019	From 01.01.2020
Unlead gasoline	476	509
Unlead gasoline with 70-85% (volume) of bioethanol (produced from agriculture origin raw materials in Latvia or imported from EU member state) mix	30% of the base rate	
Lead gasoline	594	594
Diesel oil (including diesel oil with any mix of biodiesel)	372	414
Diesel oil utilised in agriculture sector (earmarked amount per ha)	15% of the base rate	
Pure rapeseed biodiesel (produced in Latvia or imported from EU member state)	0	0
Oil gasses and other hydrocarbons (per 1000 kg)	244	285
Natural gas (per 1 MWh, highest calorific value)	9.64	9.64

Exemption from electricity taxation. Electricity Tax Law states the exemption for the electricity used for carriage of goods and public carriage of passengers including on rail transport and public transport in towns. The measure is included in the WEM scenario.

Annual taxation of vehicles. The cars' annual operation tax system based on the specific CO_2 emissions of the car (plus fixed supplement for those engines capacity of which exceeds 3500 cm^3) is introduced for the new cars (from 01.01.2017) and for the cars firstly registered in the period 01.01.2009-31.12.2016 (from 01.01.2019)[53]. For the cars with the specific CO_2 emissions up to 50 grams per km zero tax rate is applied. For the older cars the duty continues to base on engine capacity, maximal power of engine and the gross weight of the car. For duty vehicles and busses the duty is based on the gross weight of the vehicle as well as specific technical features. The measure is included in the WEM scenario.

5.3.4. Information and Education policies and measures

New passenger cars labelling on fuel economy rating provides information regarding fuel consumption (litres per 100 km or km per litre) and CO_2 emissions (grams per km). The labelling was introduced in Latvia in 2002 to fulfil the requirements of t*he Directive 1999/94/EC of the European Parliament and of the Council of 13 December 1999 relating to the availability of consumer information on fuel economy and CO_2 emissions in respect of the marketing of new passenger cars*. In July 2004 the Regulations of the Cabinet of Ministers No.608[54] came into force transposing the requirements of the *Commission Directive 2003/73/EC of 24 July 2003* amending Annex III (Description of the poster/display to be

[53] Law "On the Vehicle Operation Tax and Company Car Tax", 20 December 2010, https://likumi.lv/ta/id/223536

[54] Regulations Regarding Consumer Information to be Provided in Labelling and Promotional Publications on Fuel Consumption and CO_2 Emissions of New Passenger Cars, Cabinet of Ministers Regulation No. 608, 20 July 2004, http://likumi.lv/doc.php?id=91538

displayed at the point of sale) of the Directive 1999/94/EC. The measure is included in the WEM scenario.

5.4. Industrial processes and product use

Implementation of Best Available Techniques is the PAM which is particularly important one for GHG emissions reduction in Industrial processes and product use. Requirements set in Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (IPPC) are overtaken with national **Law "On Pollution"[55].**

The most important EU regulations affecting the amount of F-gases are:

- The Regulation (EU) No. 517/2014 of The European Parliament and of the Council on fluorinated greenhouse gases and repealing Regulation (EC) No. 842/2006. Based on the EU Regulation No. 517/2014, there is a measure in WEM scenario to reduce emisisions of F-gases;
- The Directive 2006/40/EC of the European Parliament and of the Council relating to emissions from air-conditioning systems in motor vehicles and amending Council Directive 70/156/EEC.

At national level the Regulation No. 563[56] of the Cabinet of Ministers of Latvia on special restrictions and prohibitions regarding activities with ozone-depleting substances. National regulation No. 563 is related to containment, use, recovery and destruction of certain F-gases. The Regulation No. 563 prescribes specific restrictions and prohibitions on the handling of ODS and F-gases, as well as the responsible institutions for impementation of the European Parliament and of the Council Regulation (EC) No. 1005/2009 and Regulation (EC) No. 842/2006.

Law "On Pollution" laying down the procedures by which emission of volatile organic compounds from installations, in which organic solvents are used, shall be limited. Legal norms arising from the following directives have been included in this Law:

- Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (IPPC);
- Directive 2004/42/EC of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC;
- Regulations of the Cabinet of Ministers No. 186[57] adopted on 2 April 2013 "Regulations to limit emission of volatile organic compounds from installations, in which organic solvents are used" contains legal norms arising from Directive 2010/75/EU and Regulations of the Cabinet of Ministers No. 231 adopted on 3 April 2007 "Regulations Regarding the Limitation of Emissions of Volatile Organic Compounds From Certain Products" contains legal norms arising from Directive 2004/42/EC.

[55] Law on Pollution, 15 March 2001, https://likumi.lv/doc.php?id=6075

[56] Special restrictions and prohibitions regarding activities with ozone-depleting substances and F-gases, Cabinet of Ministers Regulation No. 563, 12 July 2011, https://likumi.lv/doc.php?id=233736

[57] Regulations to limit emission of volatile organic compounds from installations, in which organic solvents are used, Cabinet of Ministers Regulation No. 186, 2 April 2013, https://likumi.lv/doc.php?id=256096

Expired Measures which have an effect, or is expected to continue to have an effect on greenhouse gas emissions

In Industrial processes and product use sector are two measures, which are expired, but have an effect on projections:

- Fluorinated greenhouse gases emissions reduction;
- Improve control of fugitive emissions from F-gases consumption and phase out particular F-gas used in mobile air conditioning.

5.5. Agriculture

5.5.1. Regulatory policies and measures

Implementation of the Nitrates Directive 91/676/EEC and Water Framework Directive 2000/60/EEC in to national legislation promoted several measures to reduce GHG emissions and indirectly affected ammonia emissions set in the National Emission Ceilings Directive 2001/81/EC. Legal norms arising from Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources have been included in Law "On Pollution" that set base to regulation on protection of water and soil from pollution with nitrates caused by agricultural activity. The Law sets requirement to the Cabinet of Ministers to regulate the criteria for determination and managing of highly vulnerable territories with increased requirements for the protection of water and soil. Law "On Pollution" also classifying polluting activities into Categories A, B, and C, considering the quantity and effect or the risk of pollution caused to human health and the environment. In agriculture sector polluting activities requiring a Category A permit are farms for the intensive rearing of pigs and poultry with more than 40 000 places for poultry or with more than 2 000 places for production pigs with weight over 30 kg (with more than 750 places for sows). These farms shall apply the best available techniques to prevent pollution.

The purpose of Law on Environmental Impact Assessment[58] is to prevent or reduce the negative impact of the implementation of the activities of a planning document thereof on the environment. Objects requiring Impact Assessment in agriculture sector are installations for the intensive rearing of pigs or poultry with more than 85000 places for broilers; 60000 places for hens; 3000 places for production pigs (over 30 kilograms); and 900 places for sows.

According to Law "On Pollution" several requirements regarding agricultural practice and manure spreading were introduced in the Regulations of the Cabinet of Ministers No. 834[59] adopted on 23 December 2014 "Regulations on protections of water and soil from pollution caused by nitrates from agricultural activities" and Regulations of the Cabinet of Ministers No. 829[60] adopted on 23 December 2014 "Specific requirements for carrying of polluting activities in animal sheds".

GHG emission reduction measures that arise from the above mentioned requirements are described below.

[58] Law on Environmental Impact Assessment, 14 October 1998, https://likumi.lv/doc.php?id=51522

[59] Regulations on protections of water and soil from pollution caused by nitrates from agricultural activities, Cabinet of Ministers No. 834, 23 December 2014, https://likumi.lv/doc.php?id=271376

[60] Specific requirements for carrying of polluting activities in animal sheds, Cabinet of Ministers No. 829, 23 December 2014, https://likumi.lv/doc.php?id=271374

Management of nitrate vulnerable zone and requirements for the protection of soil and water from agricultural pollution caused by nitrates include restrictions for nitrogen usage, promoting the reduction of nitrogen leaching and N_2O emissions. The amount of nitrogen applied with livestock manure and digestate per one hectare of agricultural land shall not exceed 170 kilograms per year. The measure is included in the WEM scenario.

Crop fertilisation plans. The main purpose of fertilization planning is to ensure optimal crop fertilization, as the lack of essential plant elements can reduce growth and productivity of plants, while unabsorbed nitrogen can result in economic and environmental losses as N_2O emissions and nitrogen runoff. The fertilization planning includes the following processes: (1) soil agrochemical research; (2) preparation of crop fertilization plan; (3) calculation of nitrogen and other plant nutrient balance. Fertilization plans are required for farms with more than 20 ha of managed agricultural land located at nitrate vulnerable zone. Fertilization plans also are required for farmers who are growing 3 and more ha of vegetables, potatoes, fruit trees or berries at nitrate vulnerable zone. The measure is included in the WEM and WAM scenario.

Requirements for manure spreading and storage. In order to ensure protection of water and soil from nitrate pollution caused by agricultural activities, fertilizers should not be spread on frozen, water saturated or snow-covered soil. Fertilizers can be spread only after the end of the potential flood season on flood-lands and areas under the threat of flood when possible floods have passed. Additionally, at nitrate vulnerable zone during the period from 20 October to 15 March, no manure and fermentation residues shall be spread, in respect of grassland – from 5 November to 15 March. Application shall not exceed the maximum permissible norms for crops. Also specific restrictions are defined for fertilization in areas with the slope. Solid manure and fermentation residues shall be incorporated into the ground within 24 hours after spreading, whereas liquid manure – within 12 hours. The main target is to increase nutrient uptake efficiency and decrease nutrient run-off and N_2O emissions.

An appropriate manure management system allows storing manure in an environment-friendly way, avoiding orreducing N_2O emissions. The measure includes the number of requirements for the collection, disposal and storage of manure. Requirements refer to farms with more than 10 animal units, and 5 AU at nitrate vulnerable zone. The measure is included in the WEM scenario.

Integated farming. Regulations of the Cabinet of Ministers No. 1056 adopted on 15 September 2009 set requirements for integrated farming in Latvia. The implementation of integrated farming is the set of activities that involve rotation of crops, soil agrochemical tests, development of crop fertilization plans, fields monitoring and limitations ofcrop protection chemicals. This measure is based on environmentally friendly cultivation technology and optimal use of fertilizers by ensuring crop health, yield and soil fertility to reduce N_2O emissions. The measure is included in the WEM scenario.

5.5.2. Economic policies and measures

The latest reform of the *Common Agricultural Policy* introduces a new instrument, the green payment, to deal with the environmental impacts of agriculture. The green measures include crop diversification, maintaining permanent grasslands and introduction of ecological focus areas. In Latvia, the current programming period until 2020, also envisages financial support for introducing mitigation measures

of GHG emissions with a focus on climate and environmentally friendly agricultural practices or the green component.

Crop diversification is designed to encourage a diversity of crops on holdings which have arable land. Land that is considered as Ecological Focus Area may include: buffer strips, nitrogen fixing crops, and other. Buffer strips promote minimizing of nitrogen leaching, however introduction of leguminous plants on arable land lead to the fertility improvement of the farm's agro system by fixing atmospheric nitrogen.

The CAP also includes the EU Regulation No. 1305/2003 of 1 January 2014 which has set the aims how to develop the agricultural sector over the 2014-2020 period: improve competitiveness in agriculture, provide sustainable natural resource management and implement efficient climate change mitigation measures, as well as ensure receiving of support for development. Acording to the EU Regulation No. 1305/2003 - Regulations of the Cabinet of Ministers No. 171 (21.04.2015) and Regulations of the Cabinet of Ministers No. 1026 (10.03.2015) are implemented in Latvia in relation to organic farming and improvement of manure management systems.

The purpose of Law on Agriculture and Rural Development (1 May 2004) is to provide a legal basis for agricultural development and to specify sustainable agricultural and rural development policy in accordance with the CAP of the European Union. Regulations of the Cabinet of Ministers No. 126 adopted on 10 March 2015 sets procedure for awarding of direct payments to farmers. The procedure is based on EU Regulation No. 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No. 637/2008 of 23 June 2008 and Council Regulation (EC) No. 73/2009 of 19 January 2009, as well as Commission Delegated Regulation (EU) No. 639/2014 of 11 March 2014 supplementing Regulation (EU) No. 1307/2013 of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy, and Commission Implementing Regulation No. 641/2014 of 16 June 2014 laying down rules for the application of Regulation (EU) No. 1307/2013 of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy. According to the law and resulting regulations – Regulations of the Cabinet of Ministers No. 126 (10.03.2015), Regulations of the Cabinet of Ministers No. 598 (30.09.2014) and Regulations of the Cabinet of Ministers No. 600 (30.09.2014) following mitigation measures of GHG emissions are implemented in Latvia.

Introduction of leguminous plants on arable land. Leguminous plants considerably increase the accumulation of symbiotically fixed atmospheric nitrogen in soil. Legumes can fix up to 300 kg N ha^{-1}. In addition, legumes provide the aftercrop with the nitrogen accumulated in soil, which reduces the amount of nitrogen to be applied in the next season. Legumes such as peas, beans, soybean, clover and alfalfa, can thus contribute to:

- reduction of the emission of the greenhouse gases carbon dioxide and nitrous oxide (CO_2 and N_2O) in comparison to emissions from nitrogen-fertilized crops;
- sequestration of carbon in the soil.

The measure is included in the WEM and WAM scenario.

Organic farming. This measure includes environmentally friendly farming methods with no influence on nature, improved cropland management and reduction of synthetic fertiliser use. Benefits of this measure are decreased nitrate leaching, increased biodiversity and redeced N_2O emissions. The state ensures support to organic farmers through subsidies. The measure is included in the WEM scenario.

Promotion of biogas production. The purpose of the measure is to use bioresources (mainly or only manure) to produce biogas which is burnt to generate electrical and/or thermal energy. By implementing this measure the manure is efficiently used, odour is reduced and high-quality fertilizer called digestate is obtained. The measure is included in the WEM and WAM scenario.

5.5.3. Voluntary negotiated measures

Precision fertiliser application is a set of activities that involve the use of the newest technologies (the GPS, the GIS, sensors, software, applications, specially equipped fertiliser spreaders, etc.) in planning of fertiliser application rates and in fertiliser spreading. This measure is market driven and leads to fertiliser savings which results in reduction of N_2O emissions. The main advantages of this activity are (1) increase in yields providing optimum crop fertilisation, (2) financial saving by ensuring that field areas with sufficient crop nutrients are not over-fertilised, (3) environmental benefits by N_2O emissions decrease and decrease in nitrate leaching. The implementation of measure can reach fertilizer savings to 15-80%. The measure is included in the WEM and WAM scenario.

Precision livestock feeding. Feed planning is a set of concerted activities: acquiring information about livestock needs (productivity tests), designing feed recipes, doing feed tests and preparing the feed. Feed planning means optimising the content of nutrients in the feed according to what is needed for animals, i.e. according to their sex, age and reproductive status. The quality of feed also plays a significant role. This measure reduces the negative impact on the environment, as a balanced diet and animal performance influence the pace of production of nitrogen from manure, which, in its turn, affects N_2O emissions. Generally, evolving of precision livestock feeding approach in cattle breeding farms turns to developing of feeding plans and promoting high quality feed use to increase the digestibility. The measure is included in the WEM and WAM scenario.

Maintenance of amelioration systems involves the renovation of existing amelioration systems or the construction of new systems in wet arable lands. An amelioration system allows to draining excessive water from the area of the root zne of a crop; as a result, oxygen can access the root as well as an optimum moisture regime sets in. The soil structure which is improved by amelioration system ensures better fertiliser absorption and less nitrogen run-off, thus affecting N_2O emissions. The measure is included in the WEM and WAM scenario.

5.6. Land use, land use change and forestry

5.6.1. Regulatory policies and measures

National Development Plan of Latvia for 2014-2020[61] sets target to increase percentage of cultivated land in the total area of agricultural land to 95% in 2020. After sharp decrease of production numbers in the livestock industry in the 90ties, it is expected that agricultural production levels will be intensified.

In Latvia, the reforms in forestry sector were started in 1998 when the The Cabinet of Ministers of the Republic of Latvia adopted the **Forest Policy**. The main goal defined in the policy is to ensure a sustainable management of Latvian forests and it is being accomplished by documents of policy planning and regulations, for example, the Forest Law and other forest related regulations.

The Forest Policy underlines that forest is an important part of Latvian environment and economics. The goals of the policy are:

- to ensure that the area of forest is not decreasing by setting limits to the forest land transformation;
- to ensure maintenance and increase of productivity of forest lands;
- to encourage afforestation of agriculturally non-effective land.

The **Forest Law**[62] is the central law of the forest sector of Latvia, stating the following goals:

- to promote economically, ecologically and socially sustainable management and utilization of forests by ensuring equal rights to all owners and legal possessors of forest, ownership privacy, independence in economic actions and equal duties;
- to regulate terms of management.

The Cabinet of Ministers defines terms of evaluation of a sustainable forest management by meeting criteria and indicators of Pan-Europe. Following the definitions of this Law, the responsibility of a forest owner or legal possessor is to regenerate forest stand after regenerative felling.

The Regulation on Determination Criteria of Compensation and Calculation of Deforestation[63] defines a procedure of calculation and compensation and criteria for negative effect caused by deforestation. It defines that the compensation to the government should be paid if the land that is registered with National Real Estate Cadaster information system as the forest area deforested. The compensation should be paid for:

- decrease of carbon dioxide attraction potential;
- reduction of biological diversity;
- decrease of quality of the environmental and natural resource protection zones and sanitary protection zone functions.

[61] National Development Plan of Latvia for 2014-2020, https://www.pkc.gov.lv/sites/default/files/inline-files/20121220_NAP2020%20apstiprinats%20Saeima_4.pdf

[62] Law on Forest, 24 February 2000, https://likumi.lv/ta/id/2825-meza-likums

[63] Noteikumi par atmežošanas kompensācijas noteikšanas kritērijiem, aprēķināšanas un atlīdzināšanas kārtību, Cabinet of Ministers No. 889, 18 December 2012, http://likumi.lv/doc.php?id=253624

Rural Development Programme 2014-2020[64] sets three long-term strategic rural development policy goals:

- competitiveness of agriculture;
- sustainable management of natural resources and climate policies;
- balanced territorial development in rural areas.

It is the most important tool contributing to the climate change mitigation in LULUCF sector. The climate change mitigation measures in LULUCF sector are designated on the base of consultations with non-governmental organizations and taking into account national circumstances, in order to pursue the mitigation potential and contribute to implementation of other policies and ecosystem services, like biological diversity and water protection.

5.6.2. Economic policies and measures

The measures proposed in the LULUCF sector action plan (529/2013/EU art 10) have been subordinated to medium term planning document: **National Development Plan of Latvia for 2014-2020**. The listing of policies is based on the final version of the Rural Development Programme 2014-2020[65].

Existing measures are split into those having long term impact after implementation and those requiring continuous investments to maintain the climate change mitigation impact. Examples of the first group of measures are reconstruction of drainage system, afforestation, pre-commercial thinning and regeneration of forest stands after natural calamities. Examples of the second group of measures are growing of legumes. The first group of measures implemented to the scale which is proposed in the Rural Development Plan for Latvia 2014-2020 are considered as existing measures in the period after 2020. Impact of other measures belonging to the second group is calculated under scenario with existing measures until 2020.

Development and adaptation of drainage systems in cropland. The activity is aimed on reconstruction and improvement of existing drainage systems in cropland to maintain and increase economic value of land and productivity of crops on drained lands. The measure has direct and indirect impact on GHG emissions in short and in long term.

Drainage systems in cropland in Latvia are usually established not for continuous operation, but to get rid of exceeding water in spring, so that the mechanical processing of soil can be started earlier, and to avoid floods during heavy rain and snow melting.

The direct impact in cropland is associated with accumulation of CO_2 in soil carbon pool due to higher productivity of the drained fields and application of more advanced management practices. The evaluation of impact of the measure considers that it will be implemented in extensively managed cropland where poor conditions of drainage systems shorten active vegetation season or production of agricultural crops is not possible at all.

[64] Latvia - Rural Development Programme (National), The Ministry of Agriculture, https://www.zm.gov.lv/lauku-attistiba/statiskas-lapas/2014-2020-gada-planosanas-periods-?nid=2187#jump

[65] Latvia - Rural Development Programme (National), The Ministry of Agriculture, https://www.zm.gov.lv/zemkopibas-ministrija/statiskas-lapas/latvijas-lauku-attistibas-programma-2014-2020-gadam?id=15616#jump

Tier 1 method of the IPCC 2006[66] is applied to compare carbon stock changes in soil in case of maintenance of the drainage systems in the cropland in good conditions and current situation. Initial carbon stock in soil is considered to be equal to the value characteristic for high activity clays (HAC soils) in temperate region – 95 tonnes ha^{-1} at 0-30 cm deep soil layer. Basic scenario (current situation) considers continuous tillage in long term cultivated cropland with moderate input of organic material in soil (carbon stock change factor for land use 0.69, for tillage 1.0 and for input of organic material 1.0). The resulting carbon stock in soil before implementation of the proposed scenarios is 65.6 tonnes C ha^{-1}.

Implementation of the measure considers a higher input of organic material (soil carbon stock change factor due to the organics input 1.1) after the drainage due to higher productivity and application of more fertilizers considering 20 years transition period. Implementation of the measure will contribute to the net CO_2 removals in soil – 1.32 tonnes CO_2 ha^{-1} annually (26.4 tonnes CO_2 ha^{-1} in total) during 20 years' period after implementation of the measure. The measure is adopted according to Regulations of the Cabinet of Ministers No. 600 adopted on 30 September 2014.

Improvements are necessary also in methodology of calculation of the climate change mitigation effect; considering the potential scale of the measure (more than 90% of croplands are drained), the Tier 1 based method should be upgraded to at least Tier 2 or Tier 3. Such improvement, projections of carbon stock changes using Yasso model (Tier 3 method), will be implemented in following submissions (after 2020) after completion of elaboration of carbon input data for the most common farm crops. The measure is included in the WEM scenario.

Support to introduction and promotion of integrated horticulture applies to the establishment of new orchards on existing cropland. Implementation of the measure will affect carbon stock in living biomass and soil. Change of the land management system, particularly, establishment of continuous ground vegetation, will affect N_2O and CH_4 emissions; however, existing methods are not elaborated. The impact of the measure is projected for the 20 years' period for soil and 30 years – for living biomass carbon pools.

The quantitative estimation of impact of the measure is done according to the Tier 1 method of the IPCC GPG LULUCF[67]. Carbon stock in living biomass after the transition period is calculated according to the Table 3.3.2 of the guidelines "Default coefficients for aboveground woody biomass and harvest cycles in cropping systems containing perennial species" – 63 tonnes C ha^{-1} in above-ground biomass with the average accumulation rate of 2.1 tonnes C ha^{-1} annually. Initial carbon stock in soil is considered 95 tonnes ha^{-1} (HAC soils in temperate region). Soil carbon stock change factors for land use, tillage and input are adopted from the recent guidelines (cropland – 0.69, regular tillage – 1.0 and moderate input – 1.00, 2006 IPCC Guidelines); respectively, before the implementation carbon stock in soil is 65.6 tonnes C ha^{-1}. The measure will contribute to CO_2 removals in soil – 8.9 tonnes CO_2 ha^{-1} annually (267 tonnes CO_2 ha^{-1} in total) during 30 years' period. The measure is adopted according to Regulations of the Cabinet of Ministers No. 171 adopted on 7 April 2015.

It is considered in the calculation of the climate change mitigation effect that the impact of the already

[66]Simon Eggleston et al., "2006 IPCC Guidelines for National Greenhouse Gas Inventories. Agriculture, Forestry and Other Land Use" in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, vol. 4, p.678.

[67] Jim Penman, et.al., Good Practice Guidancefor Land Use, Land-Use Change and Forestry (2108 -11, Kamiyamaguchi, Hayama, Kanagawa, Japan: Institute for Global Environmental Strategies (IGES), 2003), http://www.ipcc-nggip.iges.or.jp

implemented projects continues after completion of the Rural Development Plan for Latvia 2014-2020 assuming that already established orchards will be maintained without additional governmental support for investments.

Activity data on implementation of the measure are available at organization responsible for implementation of the measure. Additional information provided by the LIFE REstore project on distribution of former peat extraction sites is used to separate orchards on organic soils. The measure is included in the WEM scenario.

Growing of legumes will be implemented in the intensively managed cropland with medium input of organic material (the carbon stock change factor for input equals to 1.0), Tier 1 method. After application of the measure the management system in the affected fields, will be changed to "High, without manure" according to the 2006 IPCC Guidelines and the carbon stock change factor for input will increase to 1.11.

Implementation of the measure according to the Tier 1 method will contribute to the net CO_2 removals in soil – 1.32 tonnes CO_2 ha^{-1} annually (26.4 tonnes CO_2 ha^{-1} in total) during 20 years' period after implementation of the measure. The measure is adopted according to Regulations of the Cabinet of Ministers No. 171 adopted on 7 April 2015.

It is considered in the calculation of the climate change mitigation effect that the impact of the already implemented projects does not continue after completion of the Rural Development Plan for Latvia 2014-2020 assuming that farmers will return to conventional management methods with smaller carbon input if the support is not continued. The measure is included in the WEM scenario.

Maintenance of biodiversity in grasslands. Leaving a certain area of cropland out of conventional cropping system, if the area is not afforested or used for perennial crop production, in general will not lead to reduction of the GHG emissions or increase of CO_2 removals, because reduction of the field size should be compensated by increase of a field area in other place to maintain production, if no other productivity measures are applied. However, there is an option to reduce GHG emissions by reduction of management activities on organic soil. In the impact calculation it is assumed, that share of cropland on organic soil left for greening purposes will be equal to share of organic soils in cropland.

Conversion of cropland on organic soil to grassland will reduce CO_2 emissions. According to the IPCC 2013[68] CO_2 emissions from cropland on organic soil in temperate climatic zone equals to 28.97 tonnes CO_2 ha^{-1} annually, the emissions from grassland on organic soil in temperate climatic zone equals to 22.37 tonnes CO_2 ha^{-1} annually, respectively, the land use changes from cropland to grassland on organic soil reduce the CO_2 emissions by 6.6 tonnes CO_2 ha^{-1} annually. Conversion of 1 ha of cropland to grassland considering 4.8% share of organic soils (according to GHG inventory) would reduce CO_2 emissions by 0.3 tonnes CO_2 ha^{-1} annually. Duration of the impact of the activity depends from carbon stock in organic soil in transformed cropland on organic soil. In calculations the impact is considered equal to 20 years; however, it continues as long as the field is not returned to crop production. The measure is adopted according to Regulations of the Cabinet of Ministers No. 171 (07.04.2015).

[68] 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands, http://www.ipcc-nggip.iges.or.jp/public/wetlands/pdf/Wetlands_Supplement_Entire_Report.pdf

It is considered in the calculation of the climate change mitigation effect that the impact of the already implemented projects does not continues after completion of the Rural Development Plan for Latvia 2014-2020 assuming that farmers will return to conventional management methods if the support is not continued. The measure is included in the WEM scenario.

Development and adaptation of drainage systems in forest land is aimed on reconstruction and improvement of existing drainage systems in forest land to maintain and increase economic value of land and productivity on drained lands. The measure has a direct and indirect impact on GHG emissions in short and in long term. Living and dead biomass carbon pool is highly affected in forest land. Impact on the non-CO_2 GHG (CH_4 and N_2O) cannot be evaluated due to lack of reliable research data.

Forest drainage is one of the most efficient solutions to increase CO_2 removals in living biomass and other carbon pools in forest lands on mineral soils. The impact of drainage of organic soils according to different studies is controversial; for instance, 51 years long monitoring data on impact of drainage on a carbon stock in transitional bog in demonstrates a significant increase of carbon stock in all carbon pools, including soil. However, during the first 15 years after drainage the study area was source of emissions[69,70]. The IPCC 2014 considers that soil is the source of CO_2 emissions in all forests on organic soils, the factor of CO_2 emissions according to the guidelines is 2.6 tonnes C ha^{-1} annually. According to the IPCC 2014, the CO_2 emissions from soil in rich rewetted organic soil in temperate climatic zone are 0.5 tonnes C ha^{-1} annually; respectively, difference between soil carbon stock changes in the forest area with maintained drainage system and rewetted area on organic soil in theory is 2.2 tonnes C ha^{-1} annually. However, this is not approved by studies in neighbouring countries[71]. Due to contradictious estimates in the guidelines and the research data impact of drainage systems on soil is not considered.

The most of the forest drainage systems in forest land in Latvia are established before 1990. Proposed lifetime of a drainage system is 30 years; consequently, the most of the drainage systems are now outdated. In spite of declining of technical conditions of the drainage systems, the drained generation of trees usually continues to grow following increment curves characteristic for naturally dry forest or better. The growth rate can be disturbed by natural ageing of the forest stands, regenerative felling or intensive thinning, as well as due to severe changes in growth conditions like flooding of the area. The most common reason for "switching off" self-regulation of water regime in Latvia is regenerative felling. Therefore, it is important to prioritize reconstruction of drainage systems in mature stands before regenerative felling and young stands to secure that growth of the second generation of trees on drained lands follows the growth curves characteristic for naturally dry and drained forests.

The average annual impact of the measure on CO_2 removals is 1.3 tonnes CO_2 ha^{-1} and the average impact during the rotation period is 99 tonnes CO_2 ha^{-1}. The carbon stock change in dead wood and

[69]Lazdiņš A., Lupiķis A., "Hidrotehniskās Meliorācijas Ietekme Uz CO_2 Emisijām Mežaudzēs Uz Susinātām Augsnēm", 2014; Lupiķis A., Mūrniece S., Lazdiņš A., "Impact of Reconstruction of Forest Drainage Systems on Increase of Living Woody Biomass in Thinned Middle-Age Coniferous Stands" in Forest Ecosystems and Its Management: Towards Understanding in Complexity, 2014

[70]Lazdiņš A., Lupiķis A., Okmanis M., "Soil Carbon Stock Change due to Drainage of a Forest Stand Growing on a Transitional Bog," in Extended Abstracts of the CAR-ES Network Meeting in Finland 20.–22.10.2014, ed. Leena Finér, Leena Karvinen, and Inge Stupak, vol. 316, Working Papers of the Finnish Forest Research Institute, 2014, 48–50, http://www.metla.fi/julkaisut/workingpapers/2014/mwp316.htm

[71]Jüri-Ott Salm et al., "Global Warming Potential of Drained and Undrained Peatlands in Estonia: A Synthesis" Wetlands 29, no. 4 (December 2009): 1081–1092, doi:10.1672/08-206.1; Jüri Ott Salm, "Emission of Greenhouse Gases CO_2, CH_4, and N_2O from Estonian Transitional Fens and Ombrotrophic Bogs: The Impact of Different Land-Use Practice", 2012, http://dspace.utlib.ee/dspace/bitstream/handle/10062/25471/salm_jyri_ott.pdf?sequence=1

litter carbon pools is not considered in the calculation. The measure is adopted according to Regulations of the Cabinet of Ministers No. 600 (30.09.2014).

In the calculation of the climate change mitigation effect it is considered that the impact of the already implemented projects continues after completion of the Rural Development Plan for Latvia 2014-2020. The measure is included in the WEM scenario.

Afforestation and improvement of stand quality in naturally afforested areas. The scope of afforestation is economically and environmentally efficient utilization of agricultural lands, which are not used for food of fodder production. This is the most efficient climate change mitigation measure in LULUCF sector in the Rural development plan 2014-2020.

The afforestation secures accumulation of CO_2 in living and dead biomass, litter and soil (only in less fertile and depleted soils). The growth conditions in afforested lands usually are similar to fertile forest stand types on drained or naturally dry mineral soils. Carbon stock changes in litter are 0.37 tonnes CO_2 ha^{-1} annually during 150 years period. In average, afforestation of 1 ha will contribute to removal of 596 tonnes of CO_2 during the rotation or 7.4 tonnes of CO_2 annually. Total impact of the measure will be nearly 4 million tonnes of CO_2 or 0.05 million tonnes of CO_2 in average annually. The measure is adopted according to Regulations of the Cabinet of Ministers No. 455 adopted on 4 August 2015.

The afforestation measure was implemented also within the scope of the Rural development plan 2007-2013[72]. Total cost of implemented measure 16 238 770 €, proposed duration of impact – 81 year, proposed impact – removals of about 7 mill. tonnes CO_2. The measure is implemented according to Regulations of the Cabinet of Ministers No. 1182 adopted on 13 October 2009.

In the calculation of the climate change mitigation effect it is considered that the impact of the already implemented projects continues after completion of the Rural Development Plan for Latvia 2014-2020. The measure is included in the WEM scenario.

Regeneration of forest stands after natural disasters considers restoration of forest stands after natural disturbances, like forest fires and strong storms, as well as reconstruction of diseasing valueless forest stands. The measure will affect mainly carbon stock in living biomass and dead wood carbon pools. The breeding effect in regenerated stands is considered as a main driving force for additional CO_2 removals according to the recent research results[73].

The average additional increment of stem wood per rotation due to utilization of the improved planting material in the forest regeneration according to the given assumptions is 43 m^3 ha^{-1} (0.47 m^3 ha^{-1} annually) or 60 tonnes CO_2 ha^{-1} (0.59 tonnes CO_2 ha^{-1} annually). The measure is adopted according to Regulations of the Cabinet of Ministers No. 455 adopted on 4 August 2015.

[72] Ziņojums Lauku attīstības programmas 2007-2013 Ex-post novērtējums, 2016
https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/00/97/47/Ex-postzinojums_pielikumi_SFC2007.pdf

[73] Jansons A., Baumanis I., "Parastās priedes (Pinus sylvestris L.) klonu atlase Kurzemes zonas 2. kārtas sēklu plantācijas izveidei un sagaidāmais ģenētiskais ieguvums" Mežzinātne \textbar Forest Science 17, No. 50, 2008: 88–116; Lazdiņš A. et al., "Mežsaimniecisko Darbību Ietekmes Uz Siltumnīcas Efektu Izraisošo Gāzu Bilanci Pētījuma Programmas Izstrāde" Pārskats par pirmā etapa izpildi, 2010; Lazdiņš A., "Atbalsts Klimata Pētījumu Programmai (Starpziņojums Par 2012. Gada Darba Uzdevumu Izpildi)" ,2012, https://sites.google.com/site/lvlulucf/research-projects/atbalstsklimatapetijumuprogrammaistarpzinojumspar2012gadarezultatiem; Lazdiņš A. et al., "Mežsaimniecisko Darbību Ietekmes Uz Siltumnīcefekta Gāzu Emisijām un CO_2 Piesaisti Novērtējums (Pārskats Par 2013. Gada Darba Uzdevumu Izpildi)", 2013

In the calculation of the climate change mitigation effect it is considered that the impact of the already implemented projects continues after completion of the Rural Development Plan for Latvia 2014-2020. The measure is included in the WEM scenario.

Preventive measures of forest damages. The scope of the measure is to maintain forest fire prevention system, including reconstruction of existing and building of new fire observation towers. The potential impact of the measure on GHG emissions is not evaluated yet; however, it is well known that the towers are very efficient in early identification and localization of the forest fire, hence the area of the forest fire is considerably smaller than it would be if the fire prevention system did not exist. Therefore, scenarios with and without fire prevention system are compared to evaluate climate change mitigation effect of this measure.

The measure decreases CO_2, CO, CH_4, N_2O and NO_x emissions; however, methodologies for evaluation of impact of this measure is under development, therefore the specific GHG emission reduction potential due to implementation of this measure is not considered in the calculation. The measure is included in the WEM scenario.

Improvement of ecological value and sustainability of forest ecosystems. The scope of the measure is to support pre-commercial thinning of young stands in private forests to secure implementation of sustainable forest management practices[74] aimed to increase economic and ecological value of forests in long term.

Pre-commercial thinning has a short and long term impact. A short impact is a transfer of certain portion of the carbon from living biomass to the dead biomass pool with following conversion into CO_2 during 20 years according to Tier 1 approach according to 2006 IPCC Guidelines. The long term impact is increase of growing rate (by 15% annually in average, according to an expert judgement used in some growth models).

The climate change mitigation effect of the pre-commercial thinning is calculated as the difference between growing stock at the end of the rotation period and the difference in timber stock extracted in the commercial thinning. The growth models are derived from recent research data[75].

The average impact of the measure is additional increment of 1.4 $m^3\ ha^{-1}$ stem wood or additional removals of 1.9 tonnes $CO_2\ ha^{-1}$ annually resulting in net additional removals of 146 tonnes $CO_2\ ha^{-1}$ per rotation. Duration of the impact of the activity is 100 years; however, the most of the contribution will be reached during the first 50 years. The measure is adopted according to Regulations of Cabinet of Ministers No. 455 (04.08.2015).

In the calculation of the climate change mitigation effect it is considered that the impact of the already implemented projects continues after completion of the Rural Development Plan for Latvia 2014-2020. The measure is included in the WEM scenario.

[74] Jansons J., Zālītis P, "Dabiski Atjaunojamo Lapu Koku Apmežojumu Struktūra Un Kopšanas Iespējas" Meža Dzīve Nr.4, 1998: 12–15; Pēteris Zālītis, Sastāva Kopšanas Cirtes, 2004; Zālītis P., Lībiete Z., "Kopšanas Ciršu Režīms Egļu Jaunaudzēs" LLU Raksti 20 (315), 2008: 38–45; AS "Latvijas valsts meži," Kvalitātes Prasības Jaunaudžu Kopšanas Ciršu Izpildei (Apstiprināts Ar AS „Latvijas Valsts Meži" 20.04.2012. Rīkojumu Nr. 3.1-2.1_001a_200_12_12), 2012, https://www.lvm.lv/images/lvm/Kvalitates_prasibas_jaunaudzu_kopsanas_cirsu_izpildei.pdf

[75] Zālītis P., Mežkopības Priekšnosacījumi, 2006; Zālītis P., Jansons J., Mērķtiecīgi Izveidoto Kokaudžu Struktūra, 2009; Pēteris Zālītis et al., Četri Mežzinātņu Motīvi, 2014

Reconstruction and development of drainage systems in cropland is continuation of measure listed in the Rural Development Program 2014-2020 "Reconstruction and development of drainage systems in cropland". All project applied for the aid after 2020 will be counted as additional measures. The total area that could be affected by the measure until 2030 is 387500 ha (38 750 ha per year). This is indicative value and will be updated during adaptation of the measure in the policy documents.

The objective of the measure is to rebuild and improve existing drainage systems in cropland to maintain and increase the economic value of the land and the productivity of the crops in the drained areas. The measure may have a direct and indirect impact on GHG emissions, both in the short and long term. The direct impact of the measure on arable land is linked to the accumulation of CO_2 in the soil due to increased productivity in reclaimed land and improved land management practices. Implementation of the measure contributes to the attraction of CO_2 in the soil - 1.32 t CO_2 ha^{-1} per year for 20 years after the implementation of the measure. The calculation of the impact of the measure is actually based on the assumption that reconstruction of drainage systems takes place as preventive measure avoiding collapse of the existing drainage systems and decrease of productivity of affected croplands.

The prediction of the impact of the measure, especially between 2021 and 2030, is hampered by the fact that it is not currently possible to predict which areas will receive support and the status of the systems to be reconstructed, i.e., whether the implementation of the measure will significantly change the growth conditions in the affected areas by 2030 and whether we can predict an increase or no reduction of carbon stock in the soil compared to alternative scenarios.

The impact forecast of the measure will be improved by development of methodologies for accounting of activity data of the measure and modelling of carbon stock change using remote techniques, which will allow to objectively forecast and assess the short-term impact of the reconstruction of drainage systems on GHG emissions. This measure of continuation is included in the WAM scenario.

Establishment of new orchards is continuation of the measure "Support to introduction and promotion of integrated horticulture" which is implemented within the scope of the Regional Development Plan for Latvia 2014-2020. Only new orchards which will be established in 2021-2030 are considered in scenario with additional measures. The projected area of new orchards is 30 ha yr^{-1} (300 ha in total in the period between 2021 and 2030). This is indicative value and will be updated during adaptation of the measure in the policy documents.

The substantiation of the measure is based on increase of input of organic matter into soil with plant residues resulting in the increase of carbon stock in living biomass and soil. It is assumed that the measure is implemented in fertile croplands on mineral and organic soils. Additional impact accounted in organic soils and substantiating accumulation of carbon in soil is reduction of CO_2 emissions from soil due to land use changes.

Yasso model, country specific carbon input data and activity data will be used in estimation of the soil carbon stock changes. The project on elaboration of the biomass conversion factors and litter input data is now under implementation and will be completed in 2020. Tier 1 based estimates will be used to estimate carbon stock changes in living biomass.

Activity data used in calculation are the Field register data – area of new orchards characterized by target species and management alternatives (conventional or organic farming). Soil maps (1960^{ths}-

1980^{ths}) will be used to identify organic soils. Carbon input data in projections are estimated using Tier 1 method, Tier 3 method will be implemented until 2021. Cost of the mitigation effect will be calculated using data available at Rural Support Service. Carbon stock changes will be calculated at a level of strata organized according to dominant species and soil type. This is the only measure where National Forest Inventory polygons will be replaced by field-wise information of new orchards. This measure of continuation is included in the WAM scenario.

Undergrowth plants sown with winter crops has been implemented already within the scope of the Rural Development Plan for Latvia 2014-2020; however, not considered as a climate change mitigation measure due to lack of activity data. The projected area affected by this measure is 17500 ha yr^{-1}. This area equals to the total area affected by the measure and used in modelling of the soil carbon stock change. This is indicative value and will be updated during adaptation of the measure in the policy documents.

The substantiation of the measure is based on increase of input of organic matter into soil with plant residues resulting in the increase of carbon stock in soil. It is assumed that the measure is implemented in croplands on mineral and organic soils. In organic soils (4.9% of the affected areas according to share of organic soils in cropland in the latest GHG inventory report) impact of the measure is not accounted due to lack of scientific evidence substantiating the impact.

Yasso model, country specific carbon input data and activity data will be used in estimation of the soil carbon stock changes. The project on elaboration of the biomass conversion factors is now under implementation and will be completed in 2020.

Activity data used in calculation are the Field register data – area of cereals with undergrowth plants characterized by target species and management alternatives (conventional or organic farming). Soil maps (1960^{ths}-1980^{ths}) will be used to identify organic soils. Carbon input data in projections are estimated using Tier 1 method, Tier 3 method will be implemented until 2021. Cost of the mitigation effect will be calculated using data available at Rural Support Service. Carbon stock change will be calculated at a level of the NFI plot affected by the measure (these data should be provided by Rural Support Service) and extrapolated to the country area using statistical methods. The measure is included in the WAM scenario.

Green fallow before winter crops*.* Similarly to the measure Undergrowth plants sown with cereals this measure has been implemented already within the scope of the Rural Development Plan for Latvia 2014-2020; however, not considered as a climate change mitigation measure due to lack of activity data. The total area which will be affected by this measure until 2030 is 100858 ha (10086 ha yr^{-1}). This is indicative value and will be updated during adaptation of the measure in the policy documents. It is assumed in the modelling that the measure will be implemented in the same field every 3rd year.

The substantiation of the measure is based on increase of input of organic matter into soil with plant residues due to additional input with “green manure” before sowing of cereals resulting in the increase of carbon stock in soil. It is assumed that the measure is implemented in croplands on mineral and organic soils. In organic soils (4.9% of the affected areas according to share of organic soils in cropland in the latest GHG inventory review) impact of the measure is not accounted due to lack of scientific evidence substantiating the impact.

Yasso model, country specific carbon input data and activity data will be used in estimation of the soil carbon stock changes. The project on elaboration of the biomass conversion factors is now under implementation and will be completed in 2020.

Activity data used in calculation are the Field register data – area of winter crops sown in green fallow characterized by target cereal species and management alternatives (conventional or organic farming). Soil maps (1960^{ths}-1980^{ths}) will be used to identify organic soils. Carbon input data in projections are estimated using Tier 1 method, Tier 3 method will be implemented until 2021. Cost of the mitigation effect will be calculated using data available at Rural Support Service. The measure is included in the WAM scenario.

Introduction of legumes into conventional crop rotations is continuation of the measure "Growing of legumes" which is implemented within the scope of the Regional Development Plan for Latvia 2014-2020. All areas proposed for the support after 2020 are accounted under additional measures. The total area which will be affected by this measure until 2030 is 13% of the area of cropland and grassland. This is indicative value and will be updated during adaptation of the measure in the policy documents. It is assumed in the modelling that the measure will be implemented in the same field every 3^{rd} year.

The substantiation of the measure is based on increase of input of organic matter into soil with residues of legumes resulting in the increase of carbon stock in soil. It is assumed that the measure is implemented in croplands on mineral and organic soils. In organic soils (4.9% of the affected areas according to share of organic soils in cropland in the latest GHG inventory report) impact of the measure is not accounted due to lack of scientific evidence substantiating the impact.

Yasso model, country specific carbon input data and activity data will be used in estimation of the soil carbon stock changes. The project on elaboration of the biomass conversion factors is now under implementation and will be completed in 2020.

Activity data used in calculation are the Field register data – area of legumes sown between rotations of cereals characterized by target cereal species and management alternatives (conventional or organic farming). Soil maps (1960^{ths}-1980^{ths}) will be used to identify organic soils. Carbon input data in projections are estimated using Tier 1 method, Tier 3 method will be implemented until 2021. Cost of the mitigation effect will be calculated using data available at Rural Support Service. This measure of continuation is included in the WAM scenario.

Cumulative effect of the productivity targeted measures. There are several measures implemented in agriculture sector indirectly affecting LULUCF sector, like breeding of new crops, improvement of crop rotations, more accurate use of fertilizers, better soil scarification technologies and others, which results in an increase of productivity and bigger loads of carbon into soil by increased biomass of plant residues. These measures create cumulative effect, which can't be easily expressed in monetary terms; however they can be monitored as increase of production per area unit and verified by the national soil monitoring programs.

The substantiation of the measure is based on increase of input of organic matter into soil with plant residues resulting in the increase of carbon stock in soil. It is assumed that the measure is implemented in croplands on mineral and organic soils. In organic soils (4.9% of the affected areas according to share of organic soils in cropland in the latest GHG inventory review) impact of the measure is not accounted due to lack of scientific evidence substantiating the impact.

Yasso model, country specific carbon input data and activity data will be used in estimation of the soil carbon stock changes. The project on elaboration of the biomass conversion factors is now under implementation and will be completed in 2020.

Activity data used in calculation are the Field register data – productivity of crops characterized by target species. The national statistics needs to be improved to be able to separate productivity of crops produced in conventional and organic farms. Carbon input data in projections are estimated using Tier 1 method, Tier 3 method will be implemented until 2021. Cost of the mitigation effect will be calculated using data available at Rural Support Service. Due to complex nature of the impact all support mechanisms targeted to production and capacity raising, respectively those targeted on nature conservation and maintenance of grasslands will be excluded. The measure is included in the WAM scenario.

Reconstruction of drainage systems in forest land is continuation of the action "Development and adaptation of drainage systems in forest land" which is implemented within the scope of the Regional Development Plan for Latvia 2014-2020. All areas proposed for the support after 2020 are accounted under additional measures. The area which will be affected by this measure until 2030 is about 4% of drained forest soils, including 54% of drained forests on mineral soils and remaining area – on organic soils. This is indicative value and will be updated during adaptation of the measure in the policy documents. It is assumed in calculation that age distribution of forest stands in areas with reconstructed drainage systems corresponds to average age distribution of forests on drained soils.

The substantiation of the measure is based on comparison of growing stock in forest stands growing on naturally wet and drained soils (Figure 5.1) assuming that reconstruction of drainage system leads to development of growing stock characteristic for drained soils and alternative scenario leads to formation of stands with the growing stock characteristic for naturally wet soils. The difference appears after regeneration of forest stands and in young stands (1st age class), respectively if drainage system is reconstructed in middle age stand, no difference is predicted. It is assumed that the measure is implemented in croplands on mineral and organic soils. Soil carbon stock changes in mineral soils are not considered; in organic soils the GHG emission factors applied in the National GHG inventory report are used in calculation.

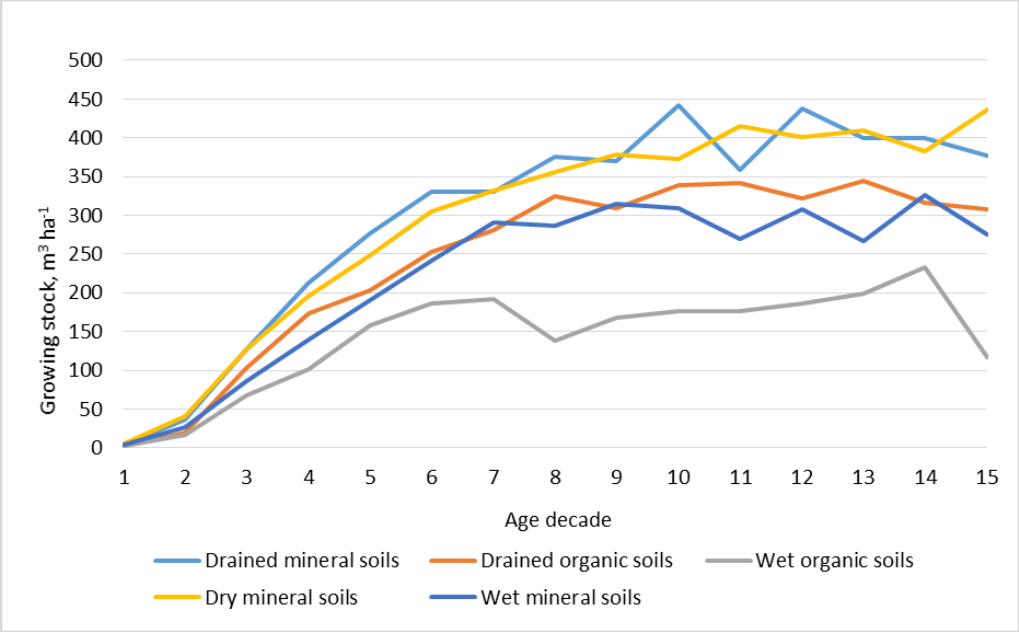

Figure 5.1 Growing stock depending from growth conditions, m^3ha^{-1}

Growth models, country specific biomass expansion factors and emission factors for organic soils will be used in estimation of the carbon stock changes. The project on evaluation of input of organic material will be implemented in 2019. Missing information on carbon stock change in drained mineral soils will be obtained within the scope of European Regional Development Fund project proposed for implementation in 2019-2021. More detailed methodology description is provided in chapter *Reconstruction of drainage systems in forest land*.

Activity data necessary for the calculation of the mitigation effect are available at Rural Support Service data – reconstruction projects, and State Forest Service – stand inventory data. Tier 3 method will be used for calculation of carbon stock change in living biomass, Tier 2 method will be implemented during following years for calculation of soil carbon stock changes. Cost of the mitigation effect will be calculated using data available at Rural Support Service. This measure of continuation is included in the WAM scenario.

Afforestation of nutrient-poor soils in grassland and cropland is continuation of the action *"Afforestation and improvement of stand quality in naturally afforested areas"* which is implemented within the scope of the Regional Development Plan for Latvia 2014-2020. All areas proposed for the support after 2020 are accounted under additional measures. The total area which will be affected by this measure until 2030 is 10000 ha (1000 ha yr^{-1}), including 4.9% of organic soils, according to the average share of organic soils in the 2018 National GHG inventory report. This is indicative value and will be updated during adaptation of the measure in the policy documents.

Methodology applied in projections of the mitigation effect is described in Chapter *Afforestation and improvement of stand quality in naturally afforested areas*. Growth models, country specific biomass expansion factors and emission factors for organic soils will be used in estimation of the carbon stock changes. Reduction of GHG emissions due to afforestation of organic soils is calculated as difference of the emission factors applied in the National GHG inventory report in grassland and forest land. Carbon

stock changes in mineral soil are not considered in the calculation due to limited and controversial information on impact of afforestation on soil carbon stock changes.

Activity data necessary for the calculation of the mitigation effect are available at Rural Support Service and State Forest Service. Tier 3 method will be used for calculation of carbon stock change in living biomass, Tier 2 method will be used for calculation of soil carbon stock changes in organic soils; Tier 3 method will be implemented for calculation of carbon stock changes in litter and soil. Cost of the mitigation effect will be calculated using data available at Rural Support Service. This measure of continuation is included in the WAM scenario.

Pre-commercial thinning is continuation of the action *"Improvement of ecological value and sustainability of forest ecosystems"* which is implemented within the scope of the Regional Development Plan for Latvia 2014-2020. All areas proposed for the support after 2020 are accounted under additional measures. The total area which will be affected by this measure until 2030 is 120000 ha (12000 ha yr^{-1}). This is indicative value and will be updated during adaptation of the measure in the policy documents.

Methodology applied in projections of the mitigation effect is described in Chapter *Improvement of ecological value and sustainability of forest ecosystems*. Growth models and country specific biomass expansion factors will be used in estimation of the carbon stock changes. Carbon stock changes in mineral soil due to increase of removals with litter and increase of dimensions of dead wood is not considered in the calculation due to limited knowledge. Considerable upgrade of the methodology and transition to Tier 3 method will be done after improvement of national growth models and verification of thinning effect.

Activity data necessary for the calculation of the mitigation effect are available at Rural Support Service and State Forest Service. Tier 3 method will be used for calculation of carbon stock change in living biomass. Tier 3 method will be implemented for calculation of carbon stock changes in litter and soil. Cost of the mitigation effect will be calculated using data available at Rural Support Service. This measure of continuation is included in the WAM scenario.

Regeneration of forest stands suffered by natural disturbances is continuation of the action *"Regeneration of forest stands after natural disturbances"* which is implemented within the scope of the Regional Development Plan for Latvia 2014-2020. All areas proposed for the support after 2020 are accounted under additional measures. The total area which will be affected by this measure until 2030 is 10000 ha (1000 ha yr^{-1}). This is indicative value and will be updated during adaptation of the measure in the policy documents.

The substantiation of the measure is based on comparison of growth rate of naturally and artificially regenerated forest stands. Regeneration with spruce, birch or pine is considered in the calculation. Methodology applied in projections of the mitigation effect is described in Chapter *Regeneration of forest stands after natural disturbances*. Growth models and country specific biomass expansion factors will be used in estimation of the carbon stock changes. Carbon stock changes in mineral soil due to increase of removals with litter and increase of dimensions of dead wood is not considered in the calculation. Upgrade of the methodology and transition to Tier 3 method will be done after improvement of national growth models and verification of the forest breeding effect.

Activity data necessary for the calculation of the mitigation effect are available at Rural Support Service and State Forest Service. Tier 3 method will be used for calculation of carbon stock change in living biomass. Tier 3 method will be implemented for calculation of carbon stock changes in litter and soil. Cost of the mitigation effect will be calculated using data available at Rural Support Service. This measure of continuation is included in the WAM scenario.

5.7. WASTE MANAGEMENT

The most important document that describes the Latvian progress and planned policies on waste management is **Waste management plan 2013-2020[76],** approved by the Cabinet of Ministers order No. 100, 21 March 2013.

Waste management plan includes measures about reducing of biodegradable waste landfilling and increase of municipal waste recycling. Decreasing of the maximum amount of biologically degradable wastes deposited on landfills according to the Landfill Directive 99/31/EC. In 2020 reduce of biodegradable waste disposing till 35% of year 1995 generated biodegradable waste amount must be reached. Decreasing of disposed waste amounts will decrease emissions of CH_4. This measure is included in WEM scenario.

Mechanical Biological treatment and sorting of municipal wastes will be established before waste disposal. Already MTB and sorting facilities operated in Latvia. In year 2020 - 50% recycling of waste according to directive 2008/98/EC requirements must be reached. Increase of recycling is one of priorities in Latvia wastes management plans. This measure will be implemented together with reducing biodegradable waste disposing.

The waste management system is one of the most important directions of the EU and Latvian legislation on environmental protection. In general, this is governed by the Latvian more than 40 laws and regulations, including the Waste Management Law, the Law on Regulators of Public Utilities, the Municipalities Law and the Natural Resources Tax Law. The Regulations of the Cabinet of Ministers, which have an effect on GHG emissions within the waste sector:

- Regulations of the Cabinet of Ministers No. 1032 adopted on 27 December 2011 "Regulations Regarding the Construction of Landfill Sites, the Management, Closure and Re-cultivation of Landfill Sites and Waste Dumps";
- “Regulations Regarding Separate Waste Collection, Preparation for Re-use, Recycling and Material Recovery”;
- Regulations of the Cabinet of Ministers No. 485 adopted on 21 June 2011 "Procedures for the Management of Certain Types of Hazardous Waste";
- Regulations of the Cabinet of Ministers No. 401 adopted on 24 May 2011" Requirements for Incineration of Waste and Operation of Waste Incineration Plants";
- Regulations of the Cabinet of Ministers No. 470 adopted on 21 June 2011 "Mining waste management procedures";
- Regulations of the Cabinet of Ministers No. 588 adopted on 30 August 2016 “Operational programme "Growth and Jobs" specific target 5.2.1. “To promote different types of waste reuse, recycling and recovery” for measure 5.2.1.2. “Waste recycling promoting” implementing rules”;

[76] Ministru kabineta rīkojums Nr.100 “Par Atkritumu apsaimniekošanas valsts plānu 2013.-2020.gadam”, https://likumi.lv/ta/id/255629-par-atkritumu-apsaimniekosanas-valsts-planu-2013-2020-gadam

- Regulations of Cabinet of Ministers No. 494 of 26 July 2016 “Operational programme "Growth and Jobs" specific target 5.2.1. “To promote different types of waste reuse, recycling and recovery” for measure 5.2.1.2. “Waste separate collection system development” implementing rules”.

In order to promote recycling and reuse of natural resources tax law sets the rate for waste disposal (Table 5.2 and Table 5.3).

Table 5.2 The tax rates for waste disposal from July 1, 2009

No.	Waste type	Unit	The tax rate for the period 01.07.2009 – 31.07.2009 (Ls)	The tax rate for the period 01.01.2010 – 31.12.2010 (Ls)	The tax rate for the period 01.01.2011 – 31.12.2011 (Ls)	The tax rate for the period from 01.01.2012. (Ls)*
1.	**Municipal waste**	tonne	1.25	3.00	5.00	7.00
2.	**Construction and building destruction waste (including soil excavated from polluted sites in non-treated form)**	tonne	1.25	5.00	10.00	15.00
3.	**Asbestos in the form of fibres and dust**	tonne	10.00	25.00	25.00	25.00
4.	**Hazardous waste**	tonne	25.00	25.00	25.00	25.00
5.	**Production waste**	tonne	1.25	3.00	10.00	15.00

** Note: 1 EUR = 0.702804 Ls*

Table 5.3 The tax rates for waste disposal from January 1, 2017

No.	Waste type	Unit	The tax rate for the period 01.01.2017 – 31.12.2017. (Euro)	The tax rate for the period 01.01.2018 – 31.12.2018. (Euro)	The tax rate for the period 01.01.2019 – 31.12.2019. (Euro)	The tax rate for the period 01.01.2020 – 31.12.2020. (Euro)
1.	**Municipal and industrial waste, which are not hazardous**	tonne	25.00	35.00	43.00	50.00
2.	**Hazardous waste (also industrial hazardous waste)**	tonne	45.00	50.00	55.00	60.00

Main policies and measures, regulating waste water handling sector, are listed below:

- Urban Waste Water Directive 91/271/EEC[77] requires to implement at least secondary treatment (which means “well managed biological treatment” in the terms of 2006 IPCC Guidelines) in all agglomerations, larger than 2000 population equivalents (p.e.) not later than 31 December of 2015. Although there is no requirement for 100% connection rate for population, living within the border of agglomeration, total number of population living in these agglomerations constitutes a major proportion of national population. Full implementation of UWWTD means that up to 75% or even more of national population will be served by well managed biological treatment of urban waste water and thus be very small or even not at all source of CH_4 emissions. However, UWWTD requires as well, that all agglomerations, larger than 10 000 p.e.,

[77] Urban Waste Water Treatment Directive 91/271/EEC, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0271

must be served by more stringent treatment (significantly decreasing in the effluent content of total nitrogen and/or total phosphorus as well) not later than 31 December of 2011. This requirement, while aimed at protection of water environment from eutrophication, in accordance with 2006 IPCC Guidelines leads to increase of N_2O emissions from modern, centralized treatment plants.

- Regulations of the Cabinet of Ministers No. 403 adopted on 21 June 2016 "The Implementing Rules of Specific Aid Objective 5.3.1. "Developing and Improving of the Water Supply and Sewerage Systems and the Quality of Services to Provide Connectivity" of Operational Program "Growth and Jobs"", designated targets and financial resources (~126 million euro from Cohesion Fund of Europe Union) to increase number of population, connected to a centralized waste water collection and treatment system in a certain agglomerations. Part of national population, not connected to a waste water collection system and treatment plant, but using septic tanks and latrines instead, is one of the main sources of CH_4 emissions from the domestic waste water handling sector. This measure should be fully implemented until 31 December of 2022.

5.8. CROSS-SECTORIAL

Latvia is implementing cross-sectorial climate change mitigation policies and measures that affect several sectors of the national economy simultaneously. Such cross-sectorial policies include implementation of the EU GHG emission allowance trading scheme, applying of fiscal instruments on CO_2 emissions, green procurement, and public information programmes to reduce GHG emissions. These measures are included in the WEM scenario.

European Union emission allowances trading system

The EU ETS, established by the *Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community*, has been in operation as from January 1, 2005. The third trading period began in January 2013 and will span until December 2020. The Latvia National Emissions Allowances Allocation Plan for 2013-2020 was approved by the *Ordinance of the Cabinet of Ministers No. 499* (2011) *"On Emissions Allowances Allocation Plan for 2013-2020: List of installations and allowances"* (with amendments in 2013)[78]. Actual amendments in the Plan were included by the Ministry of Environment Protection and Regional Development Decisions on Allocation of Emission Allowances to Operators of ETS 2013-2020 period. In 2018 65 stationary operators and 3 avio operators participated in EU ETS.

The forth trading period will start 01.01.2021 and continue 2021-2027 and will be implemented according to the *Directive 2018/410/EU of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814.* The measure is included in the WEM scenario.

CO_2 emissions taxation

The procedure of CO_2 emissions taxation is prescribed by the *Natural Resources Tax Law*[79]. The actual tax rate per ton of CO_2 emission is 4.5 EUR (the given rate is in force from 01.01.2017). The subject of

[78] Par iekārtu sarakstu emisiju kvotu sadalei 2013-2020.gadam, Cabinet of Ministers Regulation No. 499, 29 September 2011, https://likumi.lv/ta/id/236986

[79] Natural Resources Tax Law, 15 December 2005, http://likumi.lv/doc.php?id=124707

CO_2 taxation is such CO_2 emitting activities (installations), for which a GHG emission permit is required, however the amount of the activity (installation) is below the threshold limit defined for inclusion in EU ETS. The tax shall not be paid for the emissions of CO_2 which emerges (i) while using RES and local fuel peat, and (ii) from the installations participating in EU ETS. The measure is included in the WEM scenario.

Taxation on noxious air polluting emissions

Taxation on noxious air polluting emissions creates synergy effect with CO_2 taxation. The procedure of air polluting emissions taxation is prescribed by the *Natural Resources Tax Law*. The taxable are emissions of PM_{10} (actual rate - 75 EUR/ton), CO (7.83 EUR/ton), NH_3, H_2S and other non-organic compounds (18.50 EUR/ton), SO_2, NO_x, VOC, C_nH_m (85.37 EUR/ton), metals (Cd, Ni, Sn, Hg, Pb, Zn, Cr, As, Se, Cu) and their compounds recalculated for the relevant metal, V_2O_5 recalculated to vanadium (1138.30 EUR/ton). The measure is included in the WEM scenario.

Green Public Procurement

Public Procurement Law[80] states procedure for application of specific requirements for energy efficiency (Article 55). Energy efficiency, environmental protection and climate change mitigation provisions can be included in technical specifications for public supply and service contracts (Art.20.4). The measures arising on the Law and the Cabinet of Regulations (below) issued pursuant to the Law:

- the Cabinet of Ministers Regulation on green public procurement[81] relates also to electricity, energy consuming goods and services, street lightning and traffic signals, transport sector vehicles (passenger cars, public transport as well as waste collecting vehicles). Annex 1 of the Regulation states categories of goods and services for which mandatory application of criteria of green procurement is required, among them are computers, printers and other ICT equipment, in-door lightning, street lightning and traffic signals. Annex 2 states goods and services for which stated criteria of green public procurement might be used.
- the minimum energy efficiency requirements for goods and services (including tyres) procured by state central administration institutions are stated[82].

In the field of road transport sector the *Directive 2014/24/EU on Public procurement*, the legal norms regarding public procurement of the *Energy Efficiency Directive 2012/27/EU*, the *Directive 2009/33/EC on promotion of clean and energy-efficient road transport vehicles and* the *Directive 2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors* are transposed in Latvia by **Public Procurement Law**[83]. The particular Article 54 of the Law states requirements for public procurement in road transport.

Public Transport Service Provider when purchasing road transport vehicles shall take into account the effect of the putting into operation thereof on energy consumption and the environment, including CO_2 and noxious air emissions, and, in addition, may take into account, also the possibility to operate the vehicle by the fuel having high biofuel mix (above 10%), by pure biofuel or by electric power, if such

[80] Public Procurement Law, 15 December 2016, https://likumi.lv/doc.php?id=287760

[81] Requirements of Green Public Procurement and the Procedures They shall be Applied, Cabinet of Ministers Regulation No. 353, 20 June 2017, https://likumi.lv/ta/id/291867

[82] Requirements regarding Energy Efficiency to be Applied in the Goods' and Services' Public Procurements of State Direct Administration Institutions, Cabinet of Ministers Regulation No. 180, 28 March 2017, https://likumi.lv/doc.php?id=289757

[83] Public Procurement Law, 15 December 2016, http://likumi.lv/ta/id/287760

operation is technically possible and economically justified[84]. The Cabinet of Ministers Regulation No. 106 (2017) state the road transport categories for the procurement of which special requirements shall apply[85]. The measure is included in the WEM scenario.

Expired Measures which have an effect, or is expected to continue to have an effect on greenhouse gas emissions

- The particular CCFI programme "*Promotion Understanding on the Importance and Possibilities of GHG Emissions Reduction"* was implemented in years 2010-2013.
- The programme *"National Climate Policy"* of the EEA Financial Mechanism for years 2009-2014 had supported the promotion of public understanding on the importance and possibilities of GHG emissions reduction in 2015-2016**.**

[84]Law on Public Transport Services, 14 June 2007, https://likumi.lv/doc.php?id=159858

[85]Regulations on the road transport categories for the procurement of which the special requirements shall apply and the methodology for the calculation of the costs for the putting into service of the road transport referred, Cabinet of Ministers Regulation No. 106, 28 February 2017, https://likumi.lv/ta/id/289085

6. PROJECTIONS

The scenarios underlying emissions projections in the 2019 submission have incorporated new insights with regard to economic and demographic developments, sector developments, fossil fuel prices, the CO_2 price and policies when compared with the projection of BR3[86] (2017).

Greenhouse gas emissions in Latvia are projected for the years 2020, 2025, 2030 and 2035. Emission projections include and provide information about the implementation of policies and measures which are defined in policy documents developed by the government of Latvia until the year 2018. These projections correspond to the "scenario with existing measures". In addition to WEM scenario, emissions projections with planned additional measures are only described in the approved government documents, but legal regulations and implementation mechanisms have not yet been elaborated. Additional assumption scenarios are made to perform sensitivity analysis. In the case of Energy sector, parameters such as GDP growth, number of population, VA growth are changed to determine sensitivity analysis. In the Agriculture sector different assumptions about milk yield change emissions projections. In the LULUCF sector different levels of increase in intensity of forest management are used to perform sensitivity analysis but in the Waste sector macroeconomic projections are changed to make sensitivity analysis.

Key assumptions used in the projections

The GHG emission projections of Latvia are based on the long-term macroeconomic projection. MoE developed macroeconomic projections until 2030, from 2031-2035 macroeconomic projections are extrapolated. The scenario projects that the growth rates of exports and the manufacturing industry will remain comparatively high based mainly on both the increased competitiveness of Latvian producers and the growing external demand. According to this scenario it is expected that GDP, similarly to private consumption, will increase during 2019-2030. Population in Latvia is expected to continue to decrease by 27.0% from 2.239 to 1.634 million in the period from 2005 to 2030.

The main macroeconomic parameters are shown in the Table 6.1.

Table 6.1 The main macroeconomic indices applied for projecting GHG emissions

	2020	**2025**	**2030**	**2035**
Number of inhabitants, thous.	1877.60	1751.41	1634.37	1567.22
	2017 -2020	**2021 – 2025**	**2026 – 2030**	**2031 - 2035**
Private consumption, annual changes per period, %	4.0	2.6	2.0	1.8
GDP growth, annual changes per period, %	3.7	2.5	2.0	1.9
agriculture	1.9	1.7	1.3	1.2
manufacturing	5.1	2.7	2.3	2.0
service	2.8	2.6	2.1	1.9

More information regarding key parameter values applied for calculation of GHG emissions projections is presented in the Annex CTF Table 5.

[86]Third biennial report, https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-reports-annex-i-parties/third-biennial-reports-annex-i

The projections for WEM scenario show that, including the impact of implemented and adopted measures, but excluding any use of flexible mechanisms (for example, EU Emissions Trading System (EU ETS)), Latvia GHG emissions are expected to be 55.2% below 1990 levels in 2020 and 60.4% below in 2030 without LULUCF (Table 6.2).

Analyzing the projected GHG emissions and comparing them to 1990, the different dynamics are seen in sectors:

- Energy sector (without Transport sector) has the largest projected decrease of GHG emissions in 2020 and 2030 compared to 1990, 72.3% (2020) and 78.8% (2030) respectively.
- In Transport sector the projected GHG emissions in 2020 are a little bit higher than in 1990 (+1.2%), but in 2030 emissions are below 1990 level (-8.9%).
- In IPPU sector emissions are projected 15.6% increase in 2020 and 2030 against 1990 level.
- Agriculture sector is also the sector having large projected decrease of GHG emissions in 2020 and 2030 compared to 1990, 48.7% (2020) and 44.8% (2030) respectively.
- In Waste sector the projected decrease of GHG emissions constitute to 23.4% (2020) and 53.4% (2030), compared to 1990.
- The projections presented in Table 6.2 WEM include the impact of all the Latvia's implemented and adopted policies and measures. These policies and measures and their projected CO_2 eq. savings are detailed in the Annex (CTF Table 3).

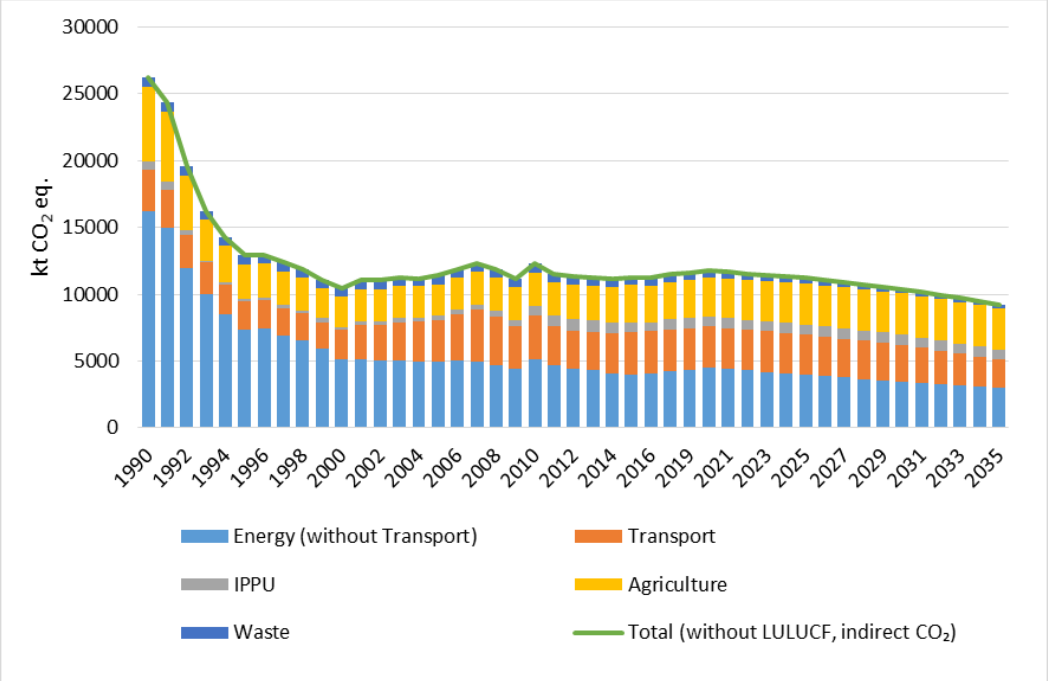

Figure 6.1 Historical and projected GHG emissions per sector in the WEM scenario (without LULUCF, indirect CO_2), kt CO_2 eq.

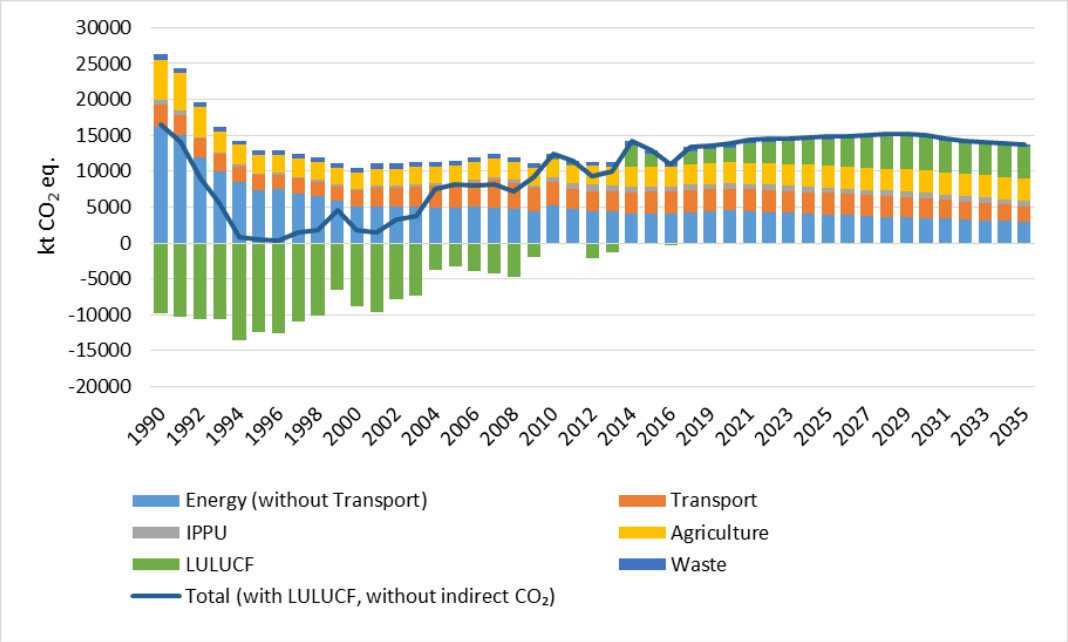

Figure 6.2 Historical and projected GHG emissions per sector in the WEM scenario (with LULUCF, without indirect CO_2), kt CO_2 eq.

The Energy sector including Transport will account for the biggest share amounting to 64.5% of the total projected GHG emissions in 2020, followed by Agriculture sector with 24.5% and Industrial processes and product use sector with 6.4% share.

Table 6.2 Historical and projected total GHG emissions per sector under WEM scenario[87], kt CO_2 eq.

	1990	2017	2020	2025	2030	2035
Energy excluding Transport	16249	3900	4505	3982	3453	3020
Transport	3040	3325	3076	3002	2771	2071
Industrial processes and product use	654	733	756	754	756	757
Agriculture	5617	2782	2879	3068	3102	3116
Waste	700	565	536	412	326	276
Total excluding LULUCF	26259	11306	11752	11219	10408	9240
Total including LULUCF	16431	9599	13846	14826	15044	13665
Land Use, Land-Use Change and Forestry	-9829	-1707	2094	3607	4636	4425

In 2030 shares of Agriculture and IPPU sectors increase in the total GHG emissions, constituting 29.8% and 7.3% respectively. At the same time contribution of Energy and Waste sectors decrease.

[87]Historical GHG emissions presented in this table do not include indirect CO_2. This is done for reasons of time series consistency with projected GHG emissions. The MMR does not require the reporting of indirect CO_2 for EU Member State projections and the projections presented in this report do therefore not include indirect CO_2

Carbon dioxide accounts for 62.0% of the total GHG emissions in 2030. N_2O and CH_4 emissions contribute respectively 20.1% and 15.9% in 2030 GHG emissions projection, the rest 1.9% is contributed by F-gases. The share of N_2O emissions in 2030 GHG emission projection will increase by 2.3% compared to 2017. The share of CO_2 emissions in 2030 GHG emission projection will decrease by 2.0% compared to 2017. Also the share of F-gases and CH_4 will decrease in 2030 respectively by 0.2% and 0.1%, see Table 6.3 and Figure 6.3.

Table 6.3 Historical and projected total GHG emissions per gas in the WEM scenario, kt CO_2 eq.

	1990	2017	2020	2025	2030	2035
Total without LULUCF, indirect CO_2	26259.46	11306.20	11752.16	11218.74	10408.29	9239.72
CO_2	19504.91	7235.24	7721.53	7189.03	6456.36	5379.15
CH_4	3537.27	1804.63	1780.95	1742.32	1655.46	1573.62
N_2O	3217.28	2021.09	2008.28	2070.15	2095.95	2103.85
F-gases	NO,NA	245.24	241.41	217.25	200.51	183.11

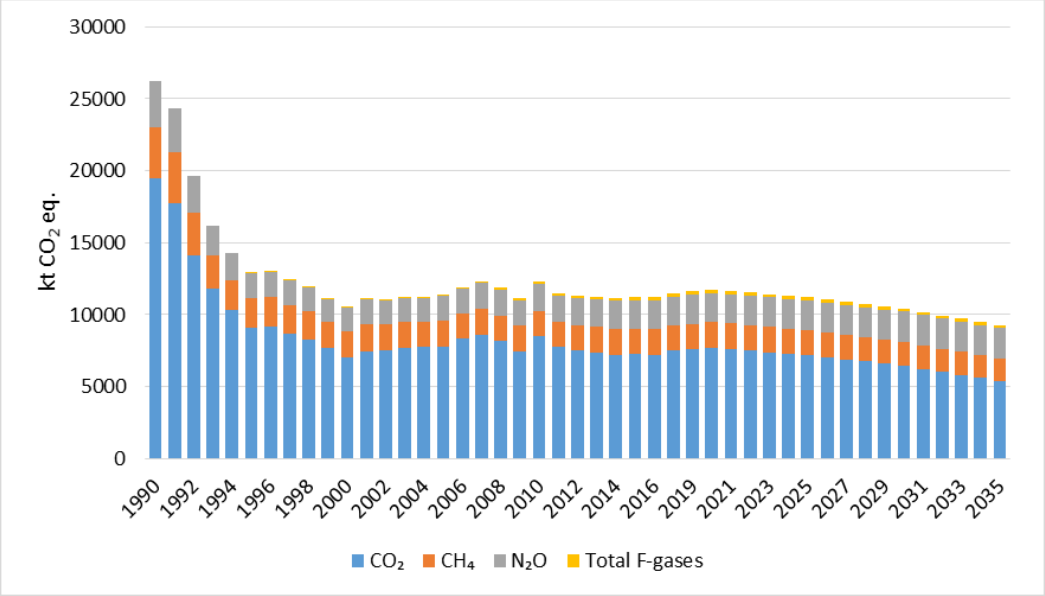

Figure 6.3 Historical and projected GHG emissions per gas in the WEM scenario, kt CO_2 eq.

The GHG emission reduction PAMs, considered within WEM scenario, show that the growth of emissions is decreasing. This tendency is reflected by the indicator (GHG emissions per GPD unit) value change, showing that in 2030 the indicator value is significantly (75.3%) lower than in 1995 and 33.5% lower compared to 2017, see Figure 6.4.

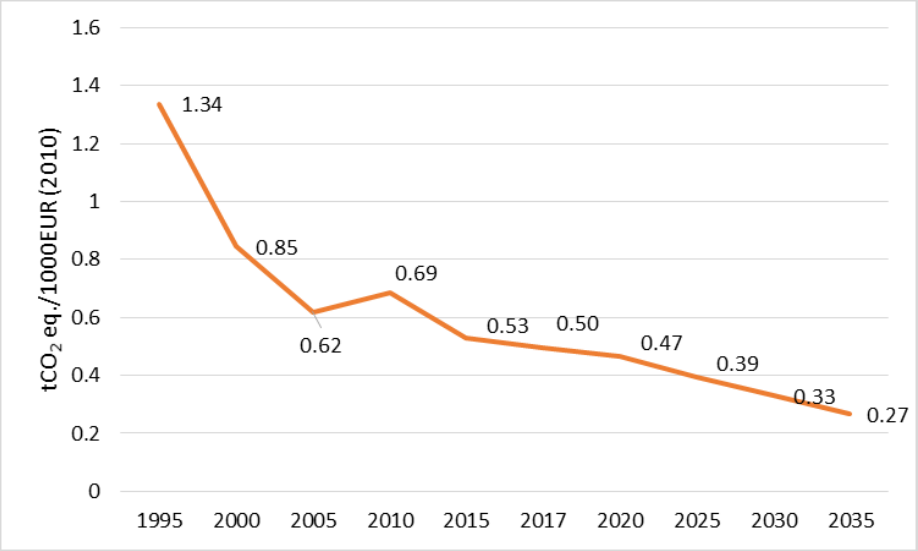

Figure 6.4 Historical and projected development of GHG intensity indicator

In addition to WEM scenario, there are also projected emissions with planned additional measures which are described in the approved government policies documents, however the implementing procedures and mechanisms of which are not yet set.

The additional GHG emission mitigation measures under the WAM scenario allow a reduction of the projected emissions. Thus, in 2020, under the WAM scenario emissions are by 1.5% lower and in 2030 by 1.4% lower than in the respective years under the WEM scenario.

Table 6.4 Historical and projected total GHG emissions per sector under scenario with additional measures[88], kt CO_2 eq.

	1990	**2017**	**2020**	**2025**	**2030**	**2035**
Energy excluding Transport	16249	3900	4330	3823	3409	2915
Transport	3040	3325	3076	3002	2771	2142
Industrial processes and product use	654	733	756	754	756	757
Agriculture	5617	2782	2879	2979	3010	3007
Waste	700	565	536	412	316	246
Total excluding LULUCF	26259	11306	11578	10970	10262	9068
Total including LULUCF	16431	9599	13672	14409	14563	13156
Land Use, Land-Use Change and Forestry	-9829	-1707	2094	3439	4301	4089

GHG emissions split between the EU ETS sector and the non-ETS sector is illustrated in Figure 6.5. The split is expected to remain roughly the same during the projected time period.

[88]Historical GHG emissions presented in this table do not include indirect CO_2. This is done for reasons of time series consistency with projected GHG emissions. The MMR does not require the reporting of indirect CO_2 for EU Member State projections and the projections presented in this report do therefore not include indirect CO_2

According to the WEM projection, the emissions from the non-ETS sector in 2020 will be around 6.4% above the 2005 level, which is sufficient for reaching the target set by the EU Climate and Energy Package (+17% compared to 2005). The calculated projections show that, the emissions from non-ETS sector in 2030 will be around 4.1% below the 2005 level.

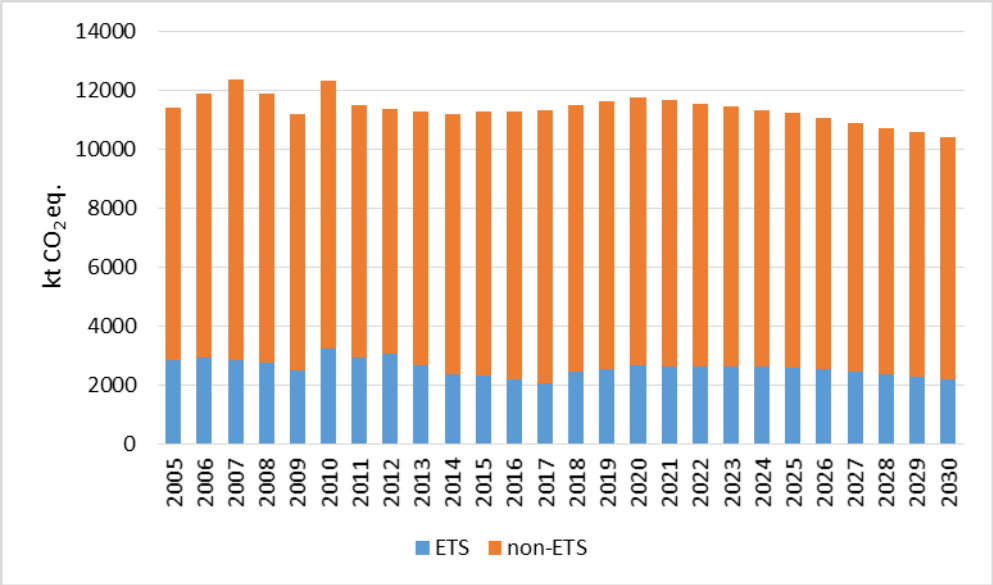

Figure 6.5 WEM projection (up to 2030) in the EU ETS and non-ETS sectors, kt CO_2 eq.

Projections of the indirect GHGs nitrogen oxides, NMVOCs and sulfur oxides, except carbon monoxide are reported under the Convention on Long-range Transboundary Air Pollution[89].

Comparison of projections between BR3 and BR4

In BR3 reference year was 2014 and projections were calculated up to 2035. Some of the main assumptions and results of the BR3 and BR4 projections are presented in Table 6.5.

[89]CLRTAP projected emissions, https://cdr.eionet.europa.eu/lv/un/clrtap/projected/envxjyxbq/Annex_IV_Projections_reporting_template_LV.xls/manage_document

Table 6.5 Comparison of projections between BR3 and BR4

	2020	2025	2030	2035
BR3 Population, thousand people	1930.35	1916.47	1915.72	1919.00
BR4 Population, thousand people	1877.60	1751.41	1634.37	1567.22
Difference between BR3 and BR4	-52.75	-165.06	-281.35	-351.78
BR3 Annual GDP growth rates, per cent	3.8	4.4	3.3	3.0
BR4 Annual GDP growth rates, per cent	3.7	2.5	2.0	1.9
Difference between BR3 and BR4	-0.1	-1.9	-1.3	-1.2
BR3 WEM total emissions (without LULUCF), kt CO_2 eq.	11565	11846	12195	12566
BR4 WEM total emissions (without LULUCF), kt CO_2 eq.	11752	11219	10408	9240
Difference between BR3 and BR4	+187	-628	-1787	-3326
BR3 WAM total emissions (without LULUCF), kt CO_2 eq.	11402	11481	11563	11962
BR4 WAM total emissions (without LULUCF), kt CO_2 eq.	11578	10970	10262	9068
Difference between BR3 and BR4	+176	-511	-1301	-2894

As seen in Table 6.5 the assumptions and the results of the two projections are different. The total WEM and WAM scenarios GHG emissions in 2030 are higher in the BR3 than in BR4. The difference is because projections are based on different macroeconomic development (GDP, VA and population) scenario. Current projections assumes the number of population in 2030 could be approximately 15% lower than in previous submission scenarios. GDP in 2019 scenario ir approximately 12% lower than in 2017 scenario.

6.1. Projected emissions per sector

6.1.1. Energy

The main policies and measures that strongly affected reduction of GHG emissions for the energy sector are the deployment of RES, energy efficiency measures and penetration of new technologies, peculiarly in Transport sector. Both the supply and demand sides are facing significant changes, part of the changes results from policy measures, part from technological development and development of the energy and fuel markets. As many of the changes involve or concern investments like power plants and heat boiler houses, the effects are robust and long lasting. In the WEM projection, the most significant future changes in electricity and heat production result from the start-up in the last three years both biomass CHP plants (with the total electric capacity of 25 MW) and biomass heat boiler plants and biomass heat boiler plants to be put into operation during next three years which replace the use of natural gas for heat production. In the WEM projection the total share of renewable energy sources in gross Final energy consumption in 2020 constitutes around 40% and increases up to around 42% in 2030. All these changes reduce emissions. In the WEM projection, Latvia remains a net importer of electricity during the projected period. Factors affecting the future energy demand are first of all energy efficiency measures, but also the economic development and structural changes within the industry.

According to the WEM projection, energy used for heating of residential and service sector buildings is decreasing even though the volume of buildings is expected to increase continuously.

FEC has been calculated based on the forecasts of macroeconomic indicators (Gross Domestic Product, Value Added by branches, private consumption, the number of population, etc.). Parameters, characterizing each separate sector of FEC, are used additionally to calculate FEC in the relevant sector, e.g. the total floor area of dwellings in residential sector, the number of households, number of vehicles, number of vehicle kilometres travelled, etc.

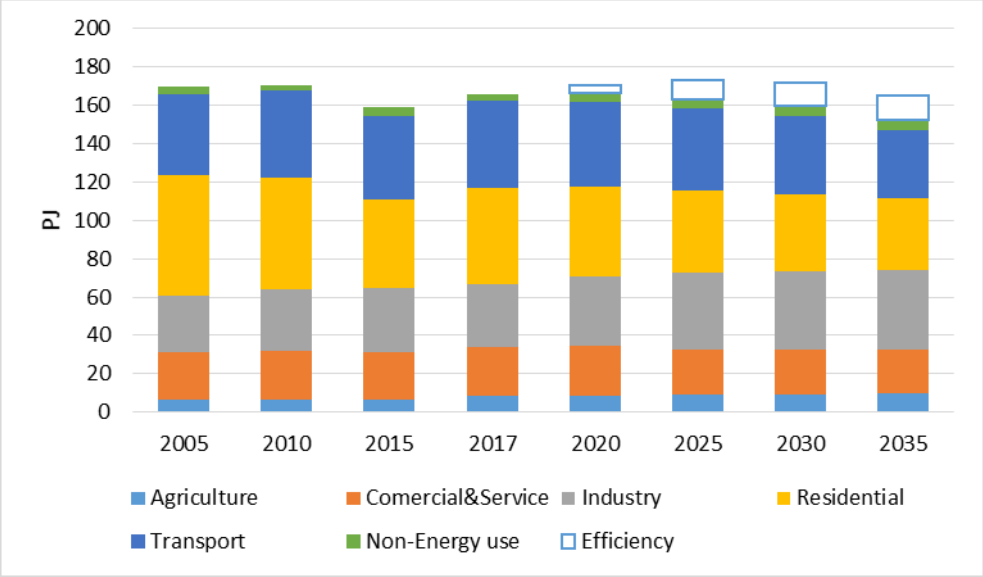

Figure 6.6 FEC development in sectors under WEM scenario, PJ

The both the assumption about the economic growth rate and change in population number and policies and measures included in WEM scenario result the FEC (without non-energy use) in 2030 will be per 4.8% lower, compared to 2017. As seen in Figure 6.6, the implemented energy efficiency policy allows to save about 12 PJ in energy end-use in 2030 (meaning that without implementation of energy efficiency measures the FEC in 2030 will be per 12 PJ higher). Energy efficiency measures mainly focus on energy efficiency improvements in buildings (both residential and public buildings), but also in Industry and Transport sector energy efficiency is improved as well.

The calculated FEC projections anticipate that in 2030 Transport and Industry will be the main FEC sectors consuming respectively 26.4% of total FEC. In its turn, households will consume 26.1% and services/tertiary sector 15% of total FEC. The rest will be consumed in Agriculture sector.

The main characteristics of Gross Primary Energy Consumption in the WEM scenario (Figure 6.7) are as follows:

- calculated GPEC in 2030 is per about 3.4% lower, compared to 2017. This GPEC decrease is caused by final energy consumption decrease in residential, services and commercial sector and transport sectors, as well as decrease in energy loss in energy transmission and distribution system;
- WEM scenario does not result in the substantial change of the primary energy resources structure. In the total GPEC in 2030 the share of natural gas and oil products will decrease per

about 2 percent points each, in its turn, consumption of solid biomass will increase per about 4 percent points. Solid biomass consumption will increase in district heating and industry.

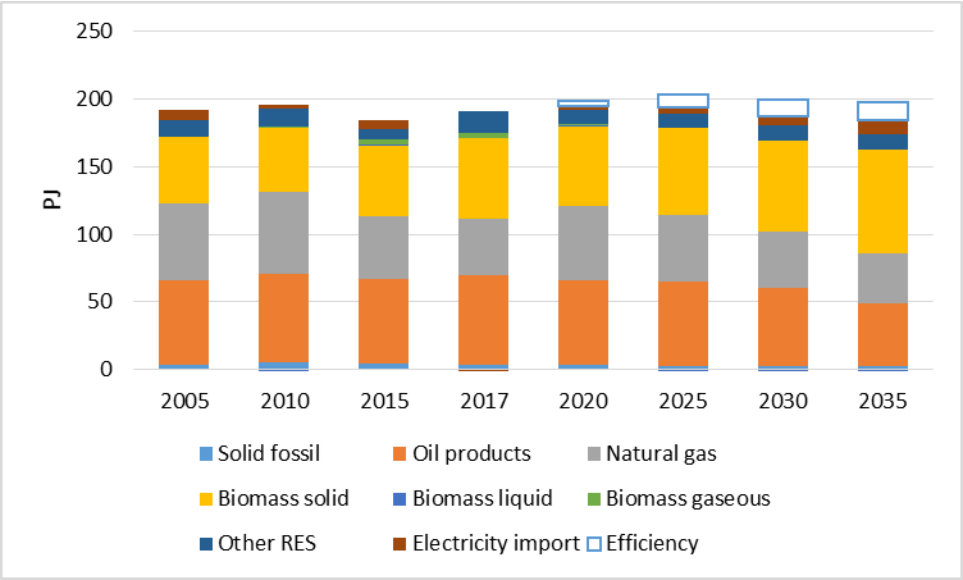

Figure 6.7 GPEC by fuels under the WEM scenario, PJ

Total GHG emissions caused by Energy sector under WEM scenario are expected to be 4.9% higher in 2020 against 2017 level and 13.9% lower in 2030. Under WEM scenario are expected to be 60.7% lower in 2020 and 67.7% in 2030 compared to 1990. Under WAM scenario the GHG emissions volume in 2020 and 2030 is respectively lower by 2.3% and 0.7% than in the WEM. All emissions from the Energy sector are represented in Table 6.6.

The implementation of the WEM scenario's measures (see the full list in CTF Table 3) will result in 2030 in GHG emission reduction per at least 685 kt CO_2 eq. (the total impact of policies and measures for which the evaluations are performed).

Table 6.6 Historical and projected GHG emissions by Energy sector, kt CO_2 eq.

Energy	1990	2017	2020	2025	2030	2035
WEM scenario	19288.96	7225.19	7580.44	6984.15	6223.72	5091.29
WAM scenario	19288.96	7225.19	7405.88	6824.81	6180.06	5057.32

The total calculated GHG emissions savings of the measures included in the WAM scenario (Investment Support Programme to Increase Energy Efficiency in Apartment Buildings and State Central Government Buildings: 2021-2027 EU Funds Programming Period) constitutes 44 kt CO_2 in 2030.

As shown in Figure 6.8, the largest share of Energy total GHG emissions in 2030 are provided by transport (44.5%), followed by energy industries (22.6%) and other sectors (20.9%).

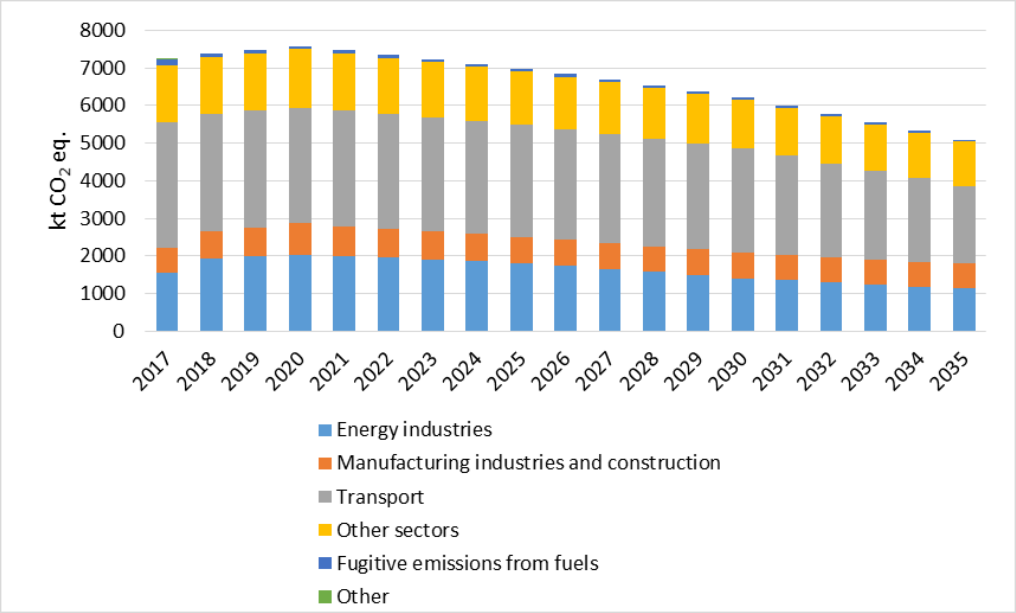

Figure 6.8 Historical and projected GHG emissions by Energy sector in WEM scenario, kt CO_2 eq.

Energy (without Transport)

The calculated projections shows that due to implementation of previously noted mitigation policies and measures (energy efficiency and RES policy) GHG emission in 2030 is per about 11.5% lower against the 2017 level. In 2030 CO_2 emissions will account for 48.8% of total CO_2 (without LULUCF) emissions in Latvia, CH_4 emissions, emitted mainly due to biomass incomplete combustion processes in small combustion equipment in residential and tertiary sector, will contribute around 13.7% of Latvia total CH_4 emissions (Table 6.7).

Table 6.7 Historical and projected GHG emissions by Energy sector (without Transport) in WEM scenario, kt CO_2 eq.

Energy (without Transport)	1990	2017	2020	2025	2030	2035
Total emissions	16248.52	3900.06	4504.89	3982.49	3452.41	3020.26
CO_2	15547.73	3443.81	4157.98	3675.55	3149.84	2752.45
CH_4	477.69	318.97	277.45	236.49	226.66	191.27
N_2O	223.11	137.29	69.47	70.45	75.91	76.54

For the period 2017-2030 there are projected different trends of GHG emissions development in particular sub-sectors. The GHG emissions of manufacturing sector will increase during the period from 2017 to 2030 taking into account the projected long-term development trends of the national economy and the government statements concerning encouragement of development and export capacity of various manufacturing branches. Production increase is projected also in such energy intensive sectors as wood industry, production of cement and lime, production of ceramic products. Calculated GHG emissions projections in 2030 is per 2.2% higher against the 2017 level in WEM scenario.

Whereas the existing and approved energy efficiency raising measures in the residential and tertiary sector will essentially affect FEC in these sectors. Correspondingly, the total FEC in “other sectors” will decrease in 2030 compared to 2017 under the WEM scenario by 13%. It is projected that the major

contributor to FEC decrease will be the residential sector (19.7%). In its turn, emissions in 2030 will decrease 14.2% in WEM scenario against 2017.

Transport

GHG emissions of inland transportation comprise road transport, railway, domestic navigation and civil aviation. GHG emissions of international aviation and navigation have been reported under International bunkers.

Irrespective of mobility and indicators characterizing the transport sector development in the period 2017-2030 – the growth of total passenger-kilometres by 11.7% and of total freight tonne-kilometres by 14.4% – the total projected GHG emissions under WEM scenario in inland transportation will decrease by 16.7% in 2030 against the 2017 level (Table 6.8). The emission reductions will be achieved by domestic and EU-wide policy measures, including promoting of the use of biofuels, improving vehicle technology and renewing the vehicle fleet. CO_2 accounts for almost 98.1% of the total GHG emissions in 2030, the share of CO_2 emissions in 2030 GHG emission projection will decrease by 0.3% compared to 2017.

Table 6.8 Historical and projected GHG emissions by Transport in WEM scenario, kt CO_2 eq.

Transport	1990	2017	2020	2025	2030	2035
Total emissions	3040.44	3325.12	3075.55	3001.66	2771.31	2071.03
CO_2	2940.78	3272.70	3023.18	2948.21	2719.77	2020.04
CH_4	19.07	4.10	4.64	5.76	6.50	12.32
N_2O	80.59	48.33	47.72	47.68	45.04	38.67

Most GHG emissions in the Transport sector are caused by road transport, which accounts for 94.8% of the total emissions in 2030 (Figure 6.9). Thus, the main emission impacting factor in the Transport sector is the penetration rate of new technologies (electric (PHV and BEV), CNG and LNG) with higher demands for emission limits and replacing the stock of the existing vehicles. This trend is already included in the emission projections under the WEM scenario.

GHG emissions in the rail transport account for about 4.4% of the total projected emissions in the transport sector in 2030. As no specific solutions for railway electrification have been developed yet, then the WEM GHG projection scenarios do not envisage transition from diesel fuel to electric energy in rail freight transport.

Navigation and local aviation account for a very small share of total emissions.

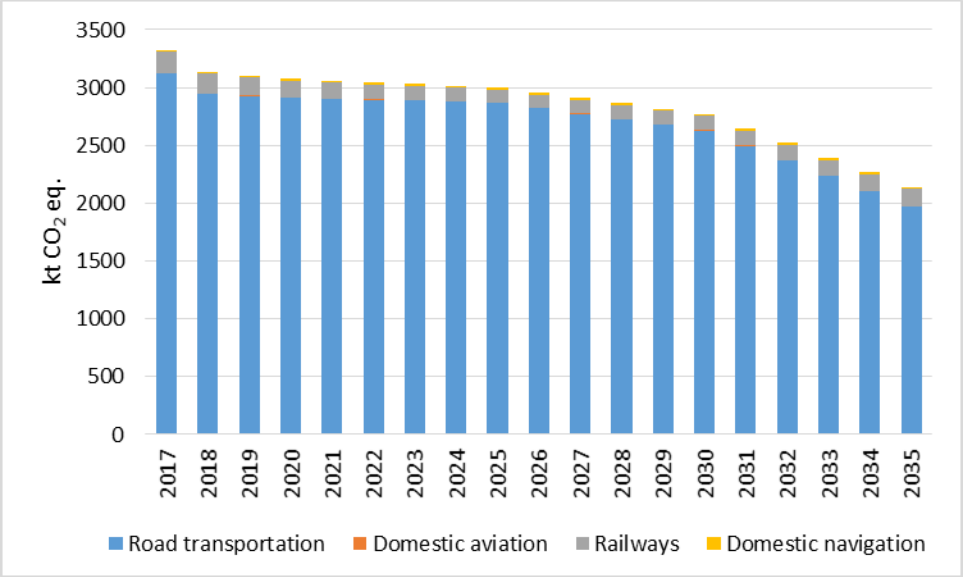

Figure 6.9 GHG emission projections by Transport sector under WEM scenario, kt CO_2 eq.

6.1.2. Industrial processes and product use

GHG emissions from the use of raw materials in technological equipment and which are not directly related to the combustion of fuel are accounted under Industrial processes, including emissions from solvent use and F-gases. As already stated above, the macroeconomic forecast envisages growth of the manufacturing sector by 2030. As most emissions from Industrial processes come from the mineral industry (cement production), then the growth of the construction sector and cement production are the main driving forces for GHG emissions projection. In cement production projected emissions will increase by 4.8% and 14.8% respectively in 2020 and 2030 compared to 2017.

The total projected GHG emissions under WEM scenario in IPPU will increase corresponding by 3.1% in 2020 and 2030 against the 2017 level. Compared to 1990, emissions will increase by 15.6% in 2020 and 2030 (Table 6.9).

Table 6.9 Historical and projected IPPU emissions according to WEM and WAM scenarios, kt CO_2 eq.

IPPU	1990	2017	2020	2025	2030	2035
WEM scenario	654.31	733.48	756.11	753.81	756.29	757.10
WAM scenario	654.31	733.48	756.11	753.81	756.29	757.10

Carbon dioxide accounts for almost 73.1% of the total GHG emissions in 2030, the share of CO_2 emissions in 2030 GHG emission projection will increase by 7.0% compared to 2017. F-gases emissions contribute 26.5% in 2030 GHG emissions projection, the rest is contributed by N_2O, see Table 6.10.

Table 6.10 Historical and projected GHG emissions in IPPU sector under WEM scenario, kt CO_2 eq.

	1990	2017	2020	2025	2030	2035
Total emissions	654.31	733.48	756.11	753.81	756.29	757.10
CO_2	650.99	484.54	511.42	533.50	552.92	571.26
CH_4	0.07	NO,NA	NA,NO	NA,NO	NA,NO	NA,NO
N_2O	3.25	3.69	3.28	3.06	2.85	2.74
F-gases	NO,NA	245.24	241.40	217.25	200.52	183.11

As it is seen in Table 6.9 WEM and WAM scenario is the same. The distribution of IPPU by sectors is represented in Figure 6.10.

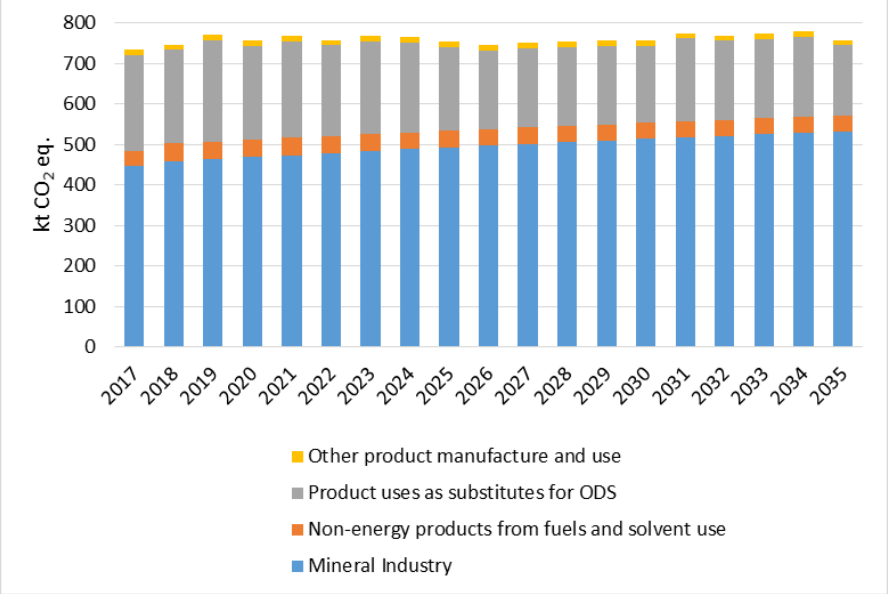

Figure 6.10 Historical and projected GHG emissions by IPPU sector, kt CO_2 eq.

GHG emissions in IPPU under the WEM scenario are projected taking into account that the production processes of enterprises will comply with the requirements provided for in the law "On Pollution". In compliance with the requirements of this law enterprises have to organise the production process by implementing the best abatement technologies providing for the lowest level of GHG emissions. This process is regulated and verified under EU ETS legislation and there are list of installations that acquires free CO_2 emission allowances.

Currently emissions from refrigeration and air conditioning equipment constitute the mayor part of total F-gas emissions (97.8% in 2017) and it is expected that emissions from these appliances will constitute the biggest share from F-gas emissions in the future. It is projected that the trend of F-gas emissions will decrease not as a straight line, but as a fluctuation. Fluctuations in F-gas emissions are because of used F-gas amounts in past. It is expected that emissions will gradually decrease due to prohibitions regarding placing on the market certain F-gases according to EC regulation on F-gases (517/2014) as well as according to prohibition to mobile air-conditioning systems designed to contain F-gases with a global warming potential higher than 150 from a certain date.

CO_2 emissions projections in the solvent use sector are calculated using top-down accounting model essentially based on the number of inhabitants and are projected to decrease slightly during the period

2017-2030. Respectively in 2020 emissions from solvent use sector are projected to decrease by 3.3% and in 2030 by 15.9% compared to 2017.

6.1.3. Agriculture

It is projected that there will be an increasing trend of total GHG emissions in the Agriculture sector during the period 2020-2035. The total GHG emissions will increase by 3.5% in 2020 and 11.5% in 2030 comparing to 2017. The total projected GHG emissions under WEM scenario in Agriculture will decrease corresponding by 48.7% in 2020 and by 44.8% 2030 against the 1990 level. The most rapid increase of emissions is related to CH_4 emission from manure management where it is expected that CH_4 emission will increase by 12.0% in 2020 and 36.9% in 2030 comparing to 2017. Also projections show an increase of N_2O emission from soils by 2.7% in 2020 and 7.9% in 2030 comparing with 2017. Under WAM scenario the GHG emissions in 2020 is the same as WEM but in 2030 is lower by 3.0% than in the WEM. All emissions from the Agriculture sector are represented in Table 6.11.

Table 6.11 Historical and projected Agriculture emissions according to WEM and WAM scenarios, kt CO_2 eq.

Agriculture	1990	2017	2020	2025	2030	2035
WEM scenario	5616.57	2782.32	2879.46	3068.44	3102.07	3115.51
WAM scenario	5616.57	2782.32	2879.46	2978.82	3009.71	3007.25

Nitrous oxide accounts for 61.9% of the total GHG emissions in 2030, the share of N_2O emissions in 2030 GHG emission projection will decrease by 2.0% compared to 2017. CH_4 and CO_2 emissions contribute respectively 37.0% and 1.1% in 2030 GHG emissions projection. The distribution of GHG in Agriculture sector can see in Table 6.12.

Table 6.12 Historical and projected total GHG emissions in Agriculture sector under WEM scenario, kt CO_2 eq.

	1990	2017	2020	2025	2030	2035
Total emissions	5616.57	2782.32	2879.46	3068.44	3102.07	3115.51
CO_2	364.84	33.90	28.66	31.48	33.55	35.12
CH_4	2411.36	968.92	1021.02	1142.37	1147.24	1143.12
N_2O	2840.37	1779.50	1829.78	1894.59	1921.28	1937.27

The largest contributing subsectors are agricultural soils and enteric fermentation. Emissions from agricultural soils will be 60.4% and 58.9% of total Agriculture sector in WEM scenario, respectively in 2020 and 2030. Enteric fermentation will be contributing 31.5% in 2020 and 32.5% in 2030. The distribution of Agriculture by sectors is represented in Figure 6.11.

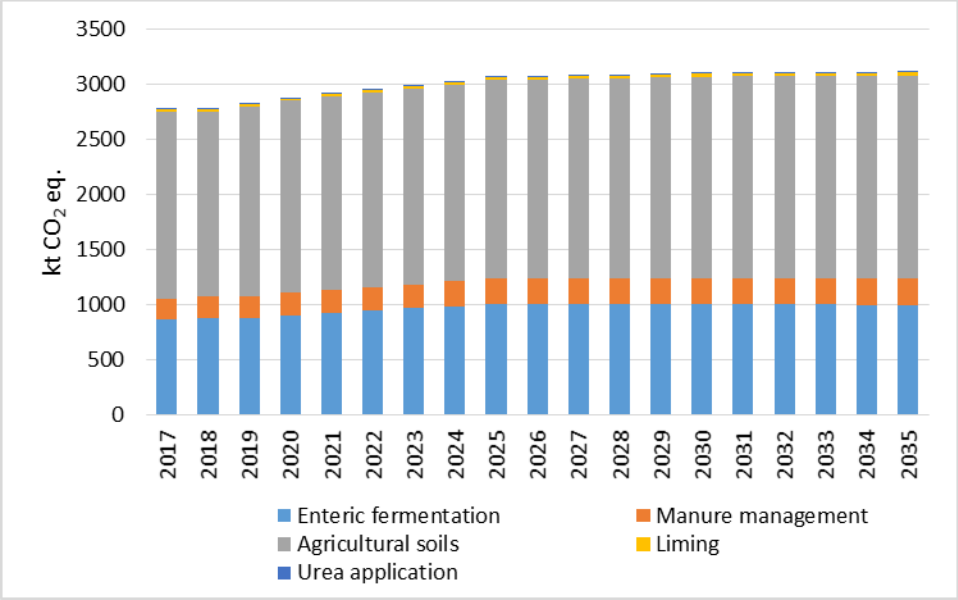

Figure 6.11 Historical and projected GHG emissions by Agriculture sector in WEM scenario, kt CO_2 eq.

CH_4 emissions from enteric fermentation emission increase by 16.2% till 2030 compared to 2017. After 2030 the intensity of annual enteric fermentation CH_4 emission growth rate will decrease. An important parameter that causes the total amount of enteric fermentation CH_4 emission is the population of ruminant livestock. Population of cattle results in more than 90% of CH_4 emission by enteric fermentation in Latvia. It is projected that dairy cows will increase by 0.8% in 2030 comparing to 2017. However, projections show that in 2030 the average annual milk yield per dairy cow will increase by +27.6% of 2017 milk yield level.

A rapid increase of dairy cows productivity will lead to an increase of gross energy (GE) intake and, consequently, to higher enteric fermentation CH_4 emission per dairy cow. For the purposes of inventory and projections GE for dairy cattle is calculated on the basis of milk yields, therefore average milk yield per cow is one of key indicators for calculation of CH_4 emissions.

Projections also show the increase of the cattle number by 16.1% in 2020 and 28.7% in 2030 comparing to 2017 that also will promote the increase of enteric fermentation CH_4 emission in the period 2020-2035. Detailed information of projected livestock numbers and dairy cow productivity is included in Table 6.13.

Table 6.13 Historical and projected livestock number, ths., and milk yield per dairy cow, kg

Type of livestock	2017	2020	2025	2030	2035
Dairy Cattle	150.4	147.3	155.9	151.6	145.2
Milk yield	6525	6898	7675	8328	8852
Cattle	255.4	296.6	333.0	328.6	321.8
Sheep	112.2	124.0	140.7	154.9	167.2
Goats	12.8	12.5	12.3	12.1	12.0
Horses	8.9	7.8	6.6	5.9	5.4
Swine	320.6	307.9	298.7	291.6	289.7
Poultry	4943.8	5010.7	5137.0	5240.9	5329.3

Projections show that manure management CH_4 emission will increase by 12.0% in 2020, and 36.9% in 2030 comparing to 2017. The main activity data for calculation of CH_4 emission from manure management is livestock population, mainly cattle, swine and poultry, and animal waste management systems distribution. It is expected that agricultural production levels of dairy farming and swine production will be intensified with the aim to improve production efficiency. This will lead to livestock concentration in big farms with preference to slurry or liquid manure management system (Table 6.14). Manure management CH_4 emission factors for slurry based systems are noticeably higher due to high methane conversion factor comparing to solid manure storage, pasture or anaerobic digesters that are also typical manure management systems for Latvia.

Table 6.14 Historical and projected manure management systems distribution (share) for dairy cattle and swine

MMS	2017	2020	2025	2030	2035
Dairy cattle					
Liquid	0.360	0.437	0.533	0.588	0.637
Solid	0.441	0.383	0.312	0.264	0.217
Pasture	0.061	0.059	0.043	0.037	0.030
Anaerobic digesters	0.138	0.121	0.112	0.111	0.116
Swine					
Liquid	0.563	0.643	0.661	0.674	0.679
Solid	0.074	0.048	0.030	0.018	0.012
Pasture	0.000	0.000	0.000	0.000	0.000
Anaerobic digesters	0.363	0.309	0.309	0.308	0.309

50% of total direct N_2O emission in 2017 from soils originated from cultivation of organic soils. Projections show that this subcategory will stay important as the main source of GHG emissions from soils till 2030; however, the share of direct N_2O emission from cultivation of organic soils will decrease to 49.5% during this time period. The main activity data for calculation of projected N_2O emission from agricultural soils contain the used amount of synthetics and organic nitrogen fertilizers, an area of harvested crops and the yield, and the cultivated area of organic soils. The calculated amounts of mineral nitrogen fertilizers are linked to a planned significant increase of areas for grain cultivation; however, the cultivation of organic soils will be reduced. Projected activity data for calculation of N_2O emissions from agricultural soils are included in Table 6.15.

Table 6.15 Historical and projected activity data for estimation of GHG emissions from agricultural soils

Activity data	2017	2020	2025	2030	2035
Used N with synthetic fertilizers, kt	77.4	83.3	87.8	90.5	92.1
Used N with manure, kt	15.5	16.0	17.2	17.2	17.1
Organic soils, ha	152.2	149.3	149.3	149.3	149.3
Wheat yield, t ha^{-1}	4.5	4.7	5.0	5.3	5.5
Barley yield, t ha^{-1}	3.0	3.1	3.3	3.5	3.6
Rye yield, t ha^{-1}	3.8	3.9	4.1	4.4	4.6
Oats yield, t ha^{-1}	1.9	2.0	2.1	2.2	2.3
Wheat sown area, ths. ha	471.6	521.6	539.7	546.5	547.1
Barley sown area, ths. ha	81.5	77.6	72.1	67.3	63.0
Rye sown area, ths. ha	34.0	31.8	30.0	28.3	27.0

Activity data	2017	2020	2025	2030	2035
Oats sown area, ths. ha	70.9	63.1	63.1	63.1	63.1

6.1.4. Land use, Land use change and forestry

The total projected GHG emissions under WEM scenario in LULUCF will increase until 2093.91 kt CO_2 eq. and 4636.20 kt CO_2 eq. in 2020 and 2030 against the 2017 level (-1706.85 kt CO_2 eq.). Under WAM scenario GHG emissions in 2020 is the same as WEM but in 2030 is lower by 7.2% than in the WEM. All emissions from the LULUCF sector are represented in Table 6.16.

Table 6.16 Historical and projected LULUCF emissions according to WEM and WAM scenarios, kt CO_2 eq.

LULUCF	1990	2017	2020	2025	2030	2035
WEM scenario	-9828.92	-1706.85	2093.91	3607.11	4636.20	4425.27
WAM scenario	-9828.92	-1706.85	2093.91	3438.78	4300.74	4088.65

Carbon dioxide accounts for 76.4% of the total GHG emissions in 2030. N_2O and CH_4 emissions contribute respectively 13.3% and 10.2% in 2030 GHG emissions projection. The distribution of GHG gases in LULUCF sector can see in Table 6.17.

Table 6.17 Historical and projected total GHG emissions in LULUCF sector under WEM scenario, kt CO_2 eq.

	1990	2017	2020	2025	2030	2035
Total emissions	-9828.92	-1706.85	2093.91	3607.11	4636.20	4425.37
CO_2	-10905.61	-2857.68	1020.04	2524.87	3543.95	3329.19
CH_4	499.05	533.24	459.58	467.25	475.07	482.50
N_2O	577.64	617.58	614.30	615.00	617.18	613.68

In 2030 the largest contributing subsectors are cropland, then wetlands and forest land. Increase of the GHG emissions in LULUCF sector is associated with reduction of net removals in living biomass in forest land due to increase of harvest rate and ageing of forests resulting in decreasing increments and increasing natural mortality. Rapid increase of mature deciduous trees stands is the main reason to forecast high and stable level of GHG emissions until 2035. Another reason for increased emissions is intensification of agricultural production resulting in conversion of fertile grasslands into croplands. The distribution of LULUCF by sectors is represented in Figure 6.12.

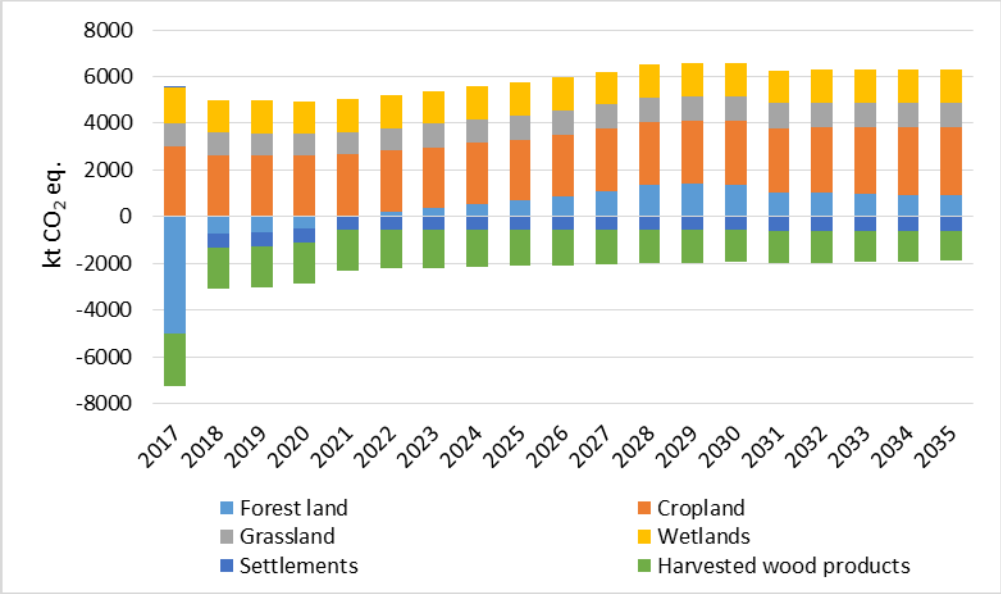

Figure 6.12 Historical and projected GHG emissions by LULUCF sector in WEM scenario, kt CO_2 eq.

The impact of the additional climate change mitigation measures proposed for inclusion into the Rural Development Plan for Latvia for the period between 2021 and 2030 will reach maximum in 2030 and, if no continuation of the actions will take place, it will reduce in following years (Figure 6.13).

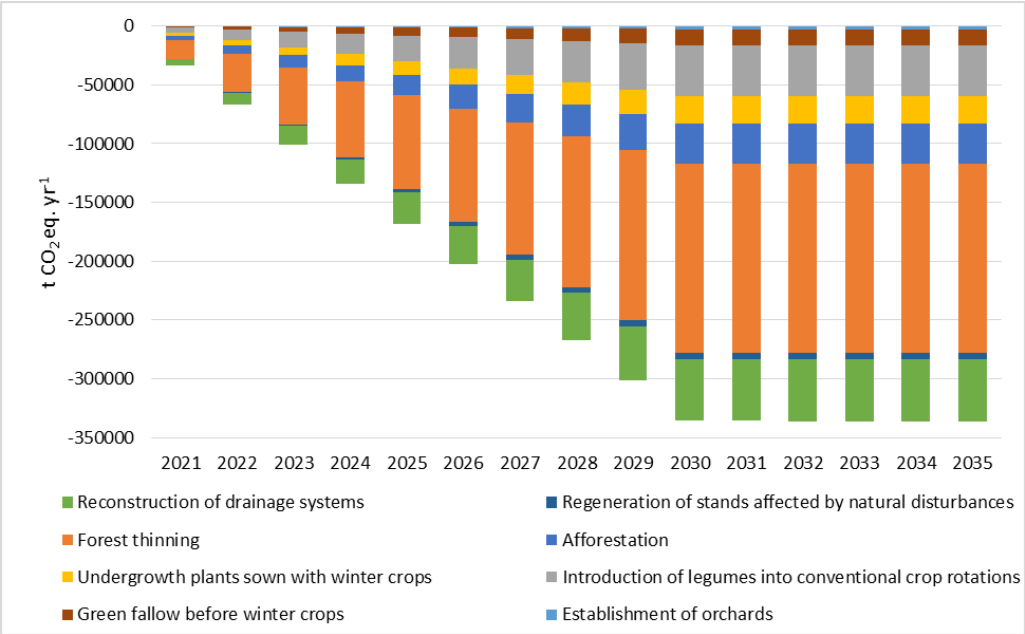

Figure 6.13 Impact of existing measures on projections of CO_2 emissions from LULUCF sector, t CO_2 yr

6.1.5. Waste management

The total projected GHG emissions under WEM scenario in Waste management will decrease corresponding by 5.1% and 42.3% in 2020 and 2030 against the 2017 level. The total projected GHG emissions under WEM scenario in Waste will decrease corresponding by 23.4% in 2020 and by 55.4% 2030 against the 1990 level. Under WAM scenario the GHG emissions volume in 2020 is the same as

WEM but in 2030 is lower by 3.1% than in the WEM. All emissions from the Waste management sector are represented in Table 6.18.

Table 6.18 Historical and projected Waste management emissions according to WEM and WAM scenarios, kt CO_2 eq.

Waste management	1990	2017	2020	2025	2030	2035
WEM scenario	699.62	565.21	536.16	412.35	326.20	275.83
WAM scenario	699.62	565.21	536.16	412.35	316.15	246.11

Methane accounts for 84.3% of the total GHG emissions in 2030, the share of CH_4 emissions in 2030 GHG emission projection will decrease by 6.4% compared to 2017. N_2O and CH_4 emissions contribute respectively 15.6% and 0.1% in 2030 GHG emissions projection. The distribution of GHG gases in Waste sector can see in Table 6.19.

Table 6.19 Historical and projected total GHG emissions in Waste management sector under WEM scenario, kt CO_2 eq.

	1990	2017	2020	2025	2030	2035
Total emissions	699.62	565.21	536.16	412.35	326.20	275.83
CO_2	0.57	0.29	0.29	0.29	0.29	0.29
CH_4	629.08	512.64	477.84	357.70	275.05	226.90
N_2O	69.96	52.28	58.03	54.37	50.87	48.64

The largest contributing subsectors are solid waste disposal (in the beginning of the period) and waste water treatment and discharge (in the end of period). While the solid waste disposal will gradually loose its contribution in total emissions of the sector, the significance of waste water treatment and discharge subsector is projected to increase, despite of gradual decrease of its emissions. The distribution of Waste management by sectors is represented in Figure 6.14.

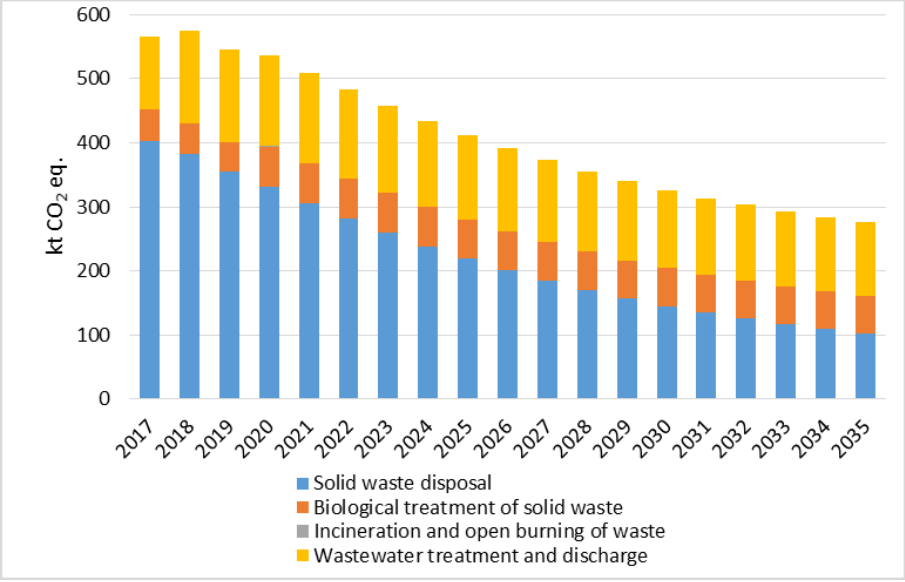

Figure 6.14 Historical and projected GHG emissions by Waste management sector, kt CO_2 eq.

SWD is the most essential GHG emission source in the Waste sector. In 2017 SWD was 71.4% from total GHG emissions of the sector, however it is projected to loose this status in 2030. The share of SWD emisisons will decrease by 27.0% compared to 2017. Biological treatment of solid waste was

48.7 kt CO_2 eq. or 8.6% from total Waste sector in 2017. It is projected that biological treatment of solid waste will produce 59.5 kt CO_2 eq. in 2030 and will contribute 18.2% of total GHG emissions in Waste sector. Incineration and open burning of waste is small subsector in Waste sector, accounting for CO_2 and N_2O emissions. Emissions are insignificant, making 0.29 kt CO_2 eq. in 2017 and in 2030. Waste water handling subsector is source of CH_4 and N_2O emissions. According to calculated projections, GHG emissions from Waste Water Handling will consequently increase from 112.8 in 2017 to 121.5 kt CO_2 eq. in 2030. Contribution of this subsector in the Waste sector is projected to increase from 20.0% in 2017 to 37.3% in 2030, WEM scenario. N_2O emissions in the waste water handling sector will gradually decrease from 0.107 in 2017 to 0.087 kt in 2030.

6.1.6. International bunkers

GHG emissions projections in International bunkering in the WEM scenario foresee different trends: emission increase in aviation and decrease in navigation. Emission increase in aviation is caused by the increase of number of both flights and served passengers in the Riga International Airport, establishing this trend the continuous increase of flights during last five years and airport development plans are considered.

Table 6.20 Historical and projected GHG emissions in International bunkers according to WEM scenario, kt CO_2 eq.

International bunkers	1990	2017	2020	2025	2030	2035
Aviation	223.01	430.55	446.15	460.78	470.90	479.22
Navigation	1571.44	883.89	893.07	903.23	903.89	900.79
Total in WEM scenario	1794.45	1314.44	1339.22	1364.01	1374.79	1380.01

6.2. Sensitivity analysis

To see the impact on changes of assumptions, alternative scenario (WEM_HD) has been made of using “optimistic scenario”.

The main macroeconomic parameters of “optimistic scenario” are shown in Table 6.21.

Table 6.21 Macroeconomic parameters of “optimistic scenario”

	2020	2025	2030	2035
Number of inhabitants, thous.	1903.42	1860.81	1835.32	1814.46
GDP at current prices, MEUR	33347.89	46341.74	60766.58	76797.79

According to this scenario it is expected that GDP, similarly to private consumption, will increase during 2019-2030. The number of population in Latvia is expected to continue to decrease by 18.0% from 2.239 to 1.814 million in the period from 2005 to 2030.

6.2.1. Energy

As underlined above, assumptions on the future change of macroeconomic’s indices are one of the most important factors when projecting GHG emissions. To evaluate the impact of macroeconomic’s indices on GHG emissions volume in the Energy sector, the GHG emissions are calculated for the

alternative scenario (WEM_HD), for constructing of which the indices (GDP, number of population, value added) of the "optimistic scenario", developed by the Ministry of Economics, are used.

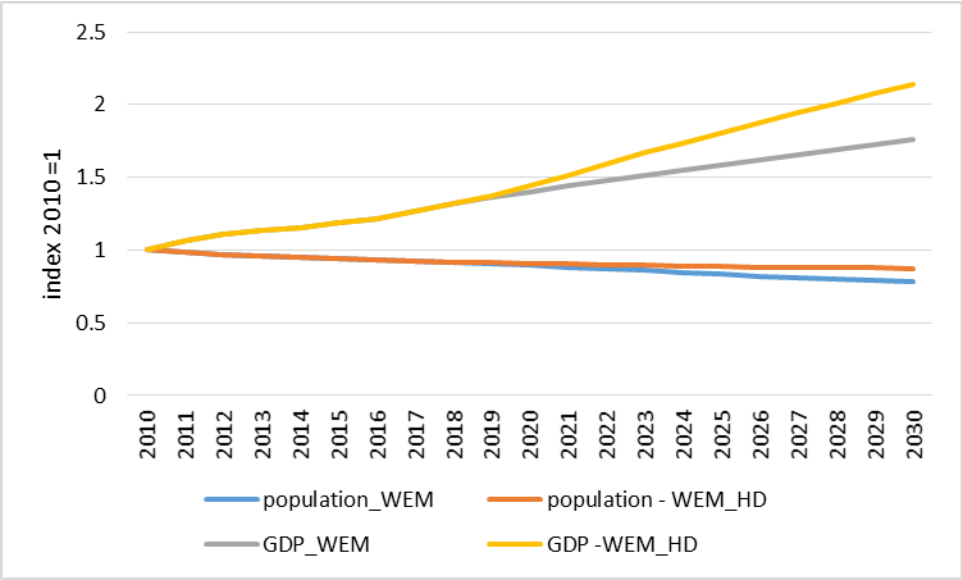

Figure 6.15 Comparison of macroeconomic's indices used in the modelled WEM and alternative (WEM_HD) scenarios

Namely, the alternative scenario (WEM_HD) assumes in 2030 the higher GDP (per about 20%) and higher number of population (per about 12%) against the WEM scenario level at 2030. As shown by the figure below, the assumptions on more rapid GDP growth rate and on stabilisation of population number result in 2030 in the increase of calculated FEC per 10% against the WEM scenario level at 2030. This increase of FEC varies in different sectors, being in 2030 in the range 5-17% against WEM scenario levels. The highest impact is seen in the residential (household) sector, in which the higher population number in the WEM_HD scenario causes per 16.9% higher FEC in 2030 against the WEM scenario level. High impact is seen also in transport sector in which in 2030 FEC in the alternative WEM_HD scenario increases per 14.2% against the WEM scenario level.

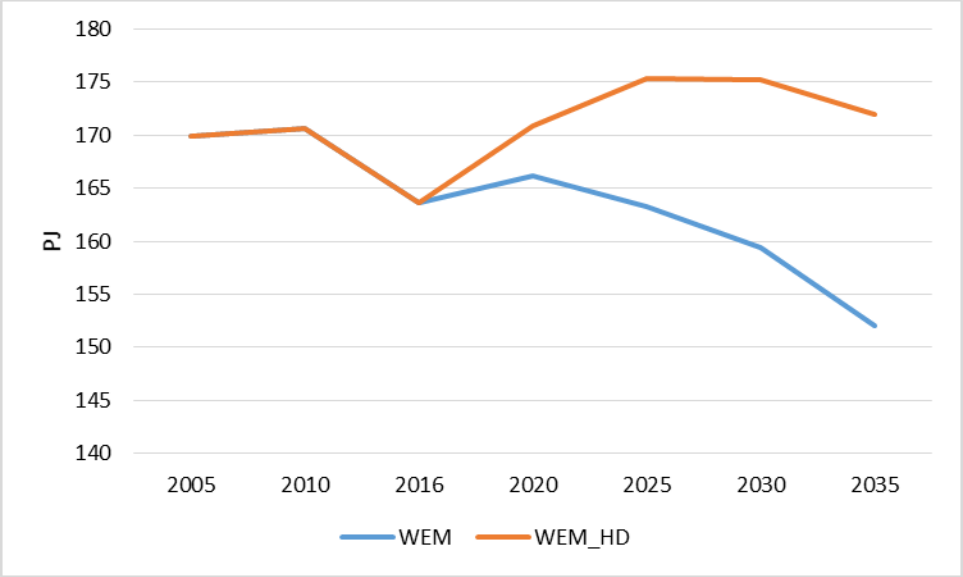

Figure 6.16 Comparison of calculated final energy consumption projections in the modelled WEM and alternative (WEM_HD) scenario, PJ

In its turn, higher energy end-use volume results in higher GHG emissions in the case the additional policies and measures aimed to decrease GHG emissions are not implemented. Calculated GHG emissions projections in 2030 in the alternative (WEM_HD) scenario is about 16.3% or 1015 kt CO_2 eq. higher, compared to WEM scenario. The highest impacts on GHG emissions increase in the WEM_HD scenario are provided by industry and road transport sectors.

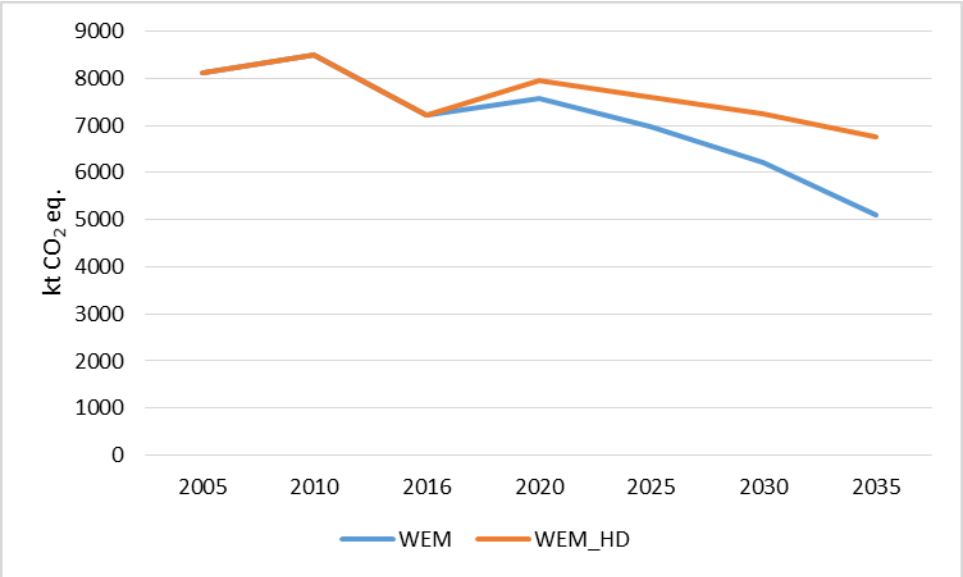

Figure 6.17 Comparison of calculated GHG emissions projections in the modelled WEM and alternative (WEM_HD) scenarios, kt CO_2 eq.

6.2.2. Agriculture

The sensitivity analysis is used to determine how different projection approaches of milk yield can impact the total emissions outcame under a given set of assumptions. Then specified activity data are included in GHG emission calculation algorithms according to 2006 IPCC Guidelines.

Sensitivity analysis has been carried out with the aim of assessing the impact of dairy cow productivity forecasts. In the baseline scenario, milk yield is predicted with a logarithmic function by setting the milk yield target value of 10 tonnes from one dairy cow in 2050. The milk target value is based on expert judgment, assuming findings that the intensity and size of farms will increase. In addition to assessing the impact of economic factors, projections of milk yield should include information on the average herd size, the proportion cow breeds, the number of organic dairy farms, feeding strategies and other biological features. In the sensitivity analysis version of the milk yield, milk yield projection is based on the milk yield models approved and used in animal sciences.

Results of a sensitivity analysis are included in Figure 6.18. Results of the sensitivity analysis show that agricultural emissions will be 3053.9 kt CO_2 eq. in 2030. Total emissions could be by 1.6% lower than in the base scenario.

All other parameters of projections for both scenarios are similar to inputs for the WEM scenario projections.

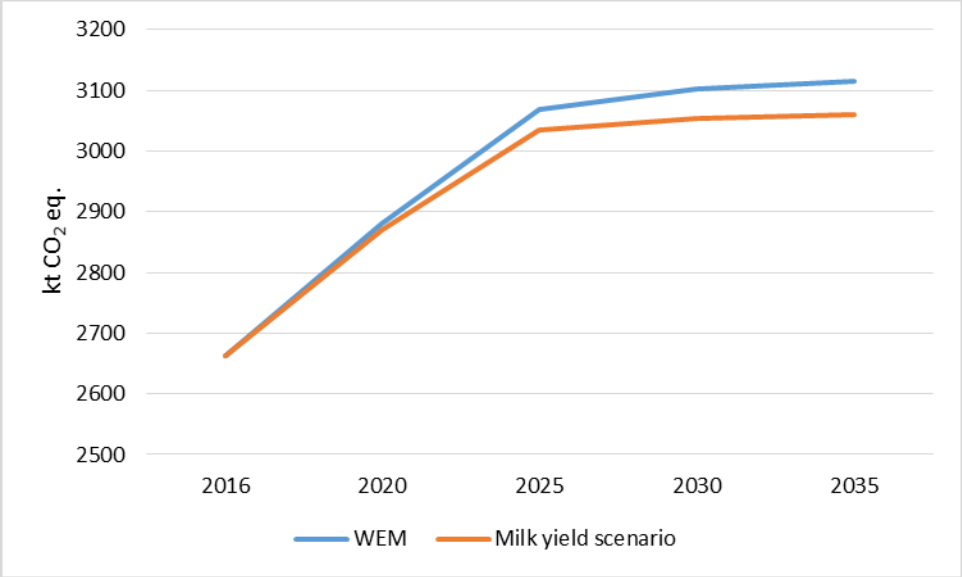

Figure 6.18 Sensitivity analysis of GHG emission projections for agriculture sector, kt CO_2 eq.

6.2.3. Land Use, Land Use Change and Forestry

Results of sensitivity analysis considering different levels of increase of intensity of forest management (proportion of wood available for and extracted in regenerative felling in comparison to the most recent 5 years average – WEM scenario) is provided in Figure 6.19. According to this estimate the increase of harvest rate will considerably increase GHG emissions in LULUCF sector in midterm prospective (until 2036). In long term prospective all scenarios considering increase of the forest management intensity above 30% in comparison to the continuation of WEM scenario leads to continuous reduction of GHG

emissions after 2036. This effect is associated with faster replacement of mature forest stands in case of more intensified forest management. It is important to consider that the proposed reduction of GHG emissions in long term in case of more intensified forest management depends from the forest regeneration practices applied – if share of actively managed forests will decrease, the intensified forest managed scenarios will result in an increase of GHG emissions. Therefore the most important indicators for prediction of the GHG emissions in forest lands are intensity of regenerative fellings and share of forest stands where artificial regeneration and purposeful pre-commercial thinning is applied.

The total GHG emissions in LULUCF sector stabilizes at a level of 5 mill. tonnes, which corresponds to GHG emissions from managed organic soils in cropland and grassland. Further reduction of GHG emissions can be reached by afforestation of organic soils in cropland and grassland and improvement of design of drainage systems to avoid fluctuations of groundwater level during the vegetation season.

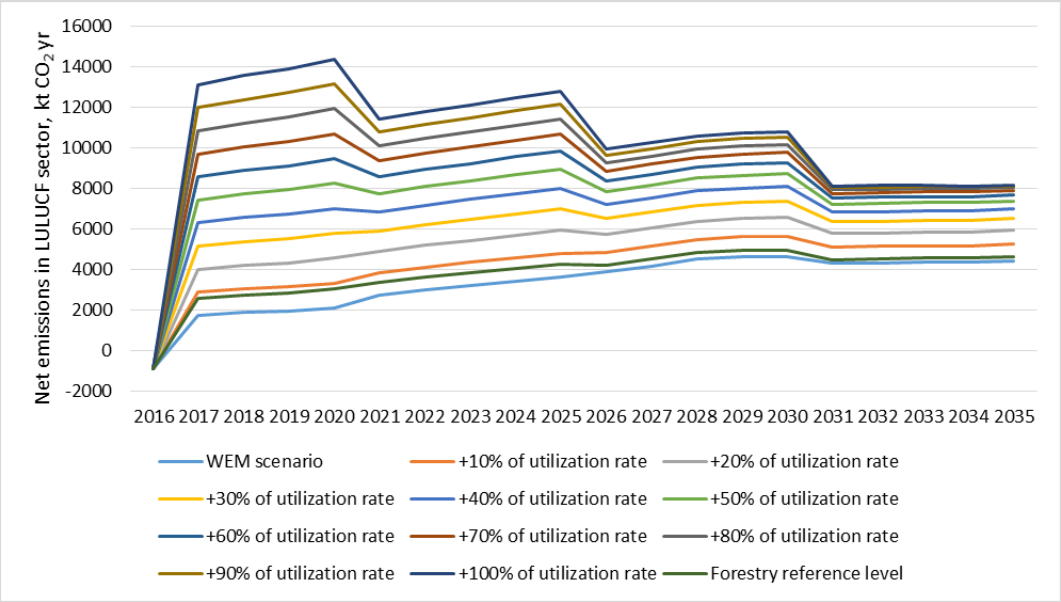

Figure 6.19 Sensitivity analysis in LULUCF sector, kt CO_2 yr

6.2.4. Waste management

6.2.4.1. Composting

One of the main parameters determining GHG emissions in the composting sector is the national population. The parameter used to prepare the sensitivity analysis is the national population projections used in “optimistic scenario”. The population is taken into account when calculating GHG emissions from household composted waste quantities.

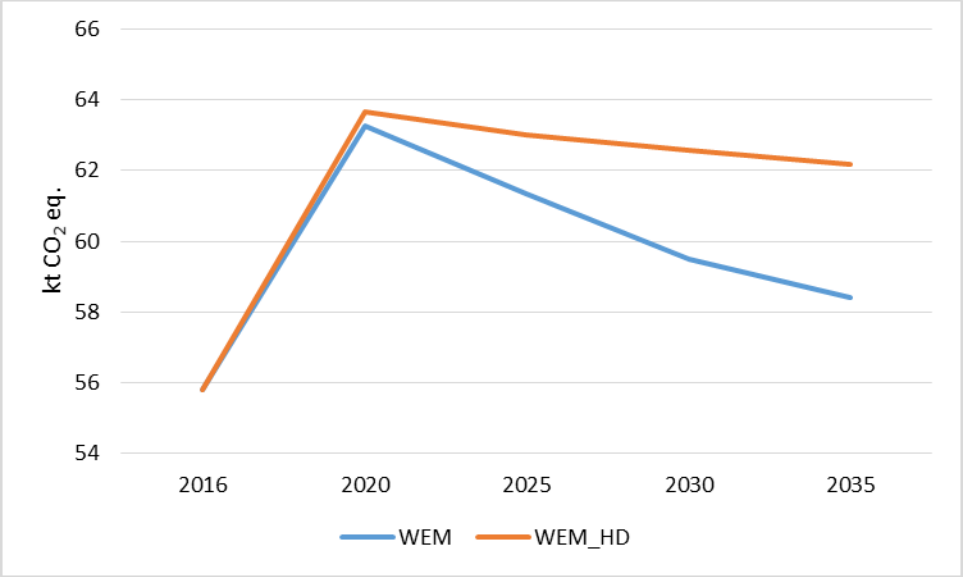

Figure 6.20 Results of composting sensitivity analysis WEM scenario compared to alternative (WEM_HD) scenario, kt CO_2 eq.

The results of analysis (Figure 6.20) show that in 2035 taking into account the different population projections, the total fluctuations in the composting sector will be almost 4 kt CO_2 eq. by WEM scenario.

6.2.4.2. Waste water handling

The main driving force of GHG emissions from the waste water handling sector is number of national population. Also, the forecasts of national population from "optimistic scenario", showing increase of national population in comparison with actual macroeconomic forecasts, were used as parameters for this sensitivity analysis.

Significant factor, impacting amount of GHG emissions in waste water handling sector, is protein consumption. For WEM scenario, it was assumed that protein consumption will stay at level of 2015-2016 (95.5 g/pers/day), while within sensitivity analysis the maximum historical protein consumption value was used – 127.1 g/pers/day (Lithuania, 2008)[90]. Also forecasts of private consumption from macroeconomic projections from the "optimistic scenario"

Results of sensitivity analysis are aggregated in Figure 6.21.

[90] Food per Person https://ourworldindata.org/food-per-person

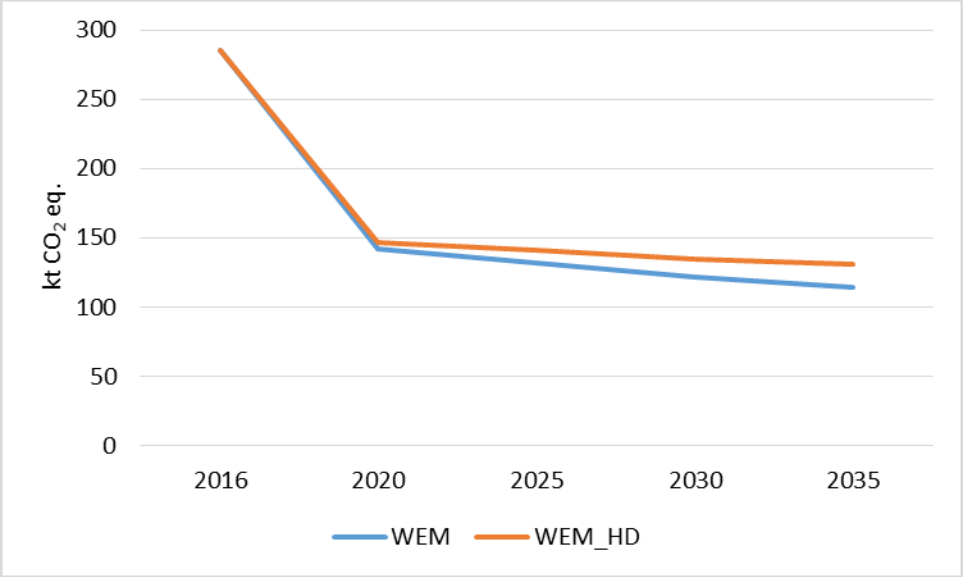

Figure 6.21 Comparison of calculated GHG emissions projections in the modelled WEM and alternative (WEM_HD) scenarios for Waste Water Handling sector, kt CO_2 eq.

WEM_HD scenario is a scenario with increase of national population, maximum protein consumption and more rapid growth of private consumption.

The results of analysis (Figure 6.21) show that assumed increase of national population, maximum protein consumption and more rapid growth of private consumption, in comparison with WEM scenario, cause a increase of GHG emissions in the waste water handling sector from 141.7 to 146.6 kt CO_2 eq. in 2020 and from 121.5 to 134.5 kt CO_2 eq. in 2030.

6.3. Models and methodology

6.3.1. Energy

To model the complex development of the Latvian energy system and perform calculation of GHG projections it is used internationally widely-applied partial equilibrium, bottom-up, dynamic, linear programming optimisation model MARKAL code for the energy-environmental system optimisation which we have been adapting to Latvia's circumstances since 1995 by creating the MARKAL-Latvia country model and applying it for the national level studies.

The MARKAL model is driven by useful energy demands, expressed in energy units or energy demands expressed as energy services in other units (e.g., lumen hours for lighting). The model integrates the end-use sectors and the supply side, holding descriptions of different energy sources and carriers that pass through the energy system's stages – transformation and distribution processes, energy end-use processes in all economic sectors, including a set of technological and energy efficiency options as well as associated emissions. The model is based on the minimization of the long term discounted cost of all modelled energy-environmental system. The system's cost includes investment and operation and maintenance costs for all technologies, plus costs of all fuels, minus the revenue from exported fuels, minus the salvage value of all residual technologies at the end of the modelled horizon. The model covers 11 periods of 5 years each, so that the modelled horizon covers 2000 to 2050, inclusive.

In the MARKAL-Latvia model the energy demand is divided in five main sectors – industry, residential, agriculture, commercial & service and transport – and further divided in subgroups or subsectors, e.g., energy consumption in the residential sector is divided into space heating and hot water in single or multifamily houses, the use of particular electrical appliances. The projection is calculated for each of these subsectors by linking directly or indirectly via elasticities and/or other indicators (e.g., energy intensities or specific consumption and changes in them, the number of households, persons per households, household area, etc.) to the economic development scenario (GDP, value added, private consumption, population). In the years 2000, 2005, 2010, 2015 and 2016, the actual installed capacities and activity levels of technologies are imposed, thus providing that the model results exactly represent the real system being modelled.

MARKAL determines future investments and activity of technologies at each time period, while ensuring demands, emission caps and sets of other different constraints.

Projection on prices of energy resources, as well as useful energy demand (energy service demand) or other secondary parameters, like the area of heated premises of buildings or mileage of cars that reflects the required amount of energy are needed as the input data in MARKAL model. Consumption of electricity and district heating is calculated internally within the model.

The model structure is adapted, so that emissions can be calculated not only by the type of fuel, but also by sector and corresponding type of technologies.

Demand for energy is directly linked with economic development, thus, the projected changes of consumption of useful energy are related to the long-term macroeconomic projections. For the purpose of developing energy demand scenario, the long-term macroeconomic projection up to year 2030 developed by the MoE, has been used. This projection has been applied in projecting electricity consumption, heat consumption, as well as fuel consumption in individual sectors.

Price projection of imported energy resources (oil products, natural gas, coal) have been developed based upon information from International Energy Agency World Energy Outlook (IEA WEO 2017, Existing Policy scenario). Prices of local energy resources depend on the geographical location of usage; therefore, the price may differ. Projection of average prices of these fuels have been developed based upon available statistics, various studies, taking into account the projection price trends of imported energy resources. Solid biomass (wood) is split to four price groups with difference available amounts of sources. Actual prices of energy resources are projected without taking into account taxes. All implemented taxes in Latvia are further added in the model.

6.3.2. Industrial processes and product use

6.3.2.1. Industrial processes

GHG emissions projections in the Industrial processes are calculated using top-down accounting model. The model includes both the projection of activity data and GHG emission calculation. For calculation of GHG emissions the historical emissions factors of the latest submitted inventory are applied and these factors are constant for all projected time period. In its turn, the necessary activity data are projected based on the historical data and the macro-economic parameters characterizing the development of particular branch of industry sector (value added or industrial production index).

6.3.2.2. F-gases

F-gas projections calculation is based on MS Excel top-down accounting model. The structure and emission calculation is performed according to 2006 IPCC Guidelines and adjusted for projection estimation incorporating parameters according to macroeconomic forecast.

The use of F-gases is projected taking into account:

- number of inhabitants, households and the number of freezing equipment (refrigerators and freezers) used;
- the development of the service sector and the amount of stationary refrigeration used in it;
- changes in the number of road transport which determine the amount of the used air conditioning systems in motor vehicles;
- the projection of F-gases under the WEM scenario is based on the assessed impacts of the EC regulation on F-gases (517/2014) repealing regulation 842/2006 and the EC directive on emissions from air conditioning systems in motor vehicles (2006/40/EC) (MAC Directive).

6.3.2.3. Solvent Use

CO_2 emissions projections in the solvent use sector are calculated using top-down accounting model essentially based on the number of inhabitants. The structure and emission calculation is performed according to EMEP/EEA 2016 and 2006 IPCC Guidelines.

6.3.3. Agriculture

Projections of emissions with existing measures are based on primary activity data provided by Ministry of Agriculture of Republic of Latvia in collaboration with Latvia University of Life Sciences and Technologies. Econometric scenario based model *Latvian Agricultural Sector Analysis Model* is used for the activity data generation of Latvian agriculture. LASAM provides an outlook for animal farming, producing forecasts in dairy, beef, sheep, goat, pig, poultry and horse farming and crop farming based on regression analysis principles. LASAM estimates a forecast of the utilised agricultural area and the structure of UUA, allow calculating the use of fertilisers in the Agriculture sector. The source data for the calculations within the model are gathered from Central Statistical Bureau of Latvia, EUROSTAT, domestic use balance sheets and Farm Accountancy Data Network. The exogenous price forecasts until 2025 are gathered from the DG AGRI of the European Commission and Food and Agriculture Organization of the United Nations, further projected by the team of Latvia University of Life Sciences and Technologies. The macroeconomic forecasts are integrated from the forecasted values of Latvia Ministry of Economics.

Secondary data projections including manure management system distribution, nitrogen excretion of livestock, use of organic fertilizer nitrogen and nitrogen content in crop residues are done by Latvia University of Life Sciences and Technologies experts based on results of pre-defined project “Development of the National System for Greenhouse Gas Inventory and Reporting on Policies, Measures and Projections” under 2009–2014 EEA Grants Programme National Climate Policy. Methodological approach used for manure management distribution projections are available in the

scientific literature[91] Projections of managed organic soils are provided by Latvian State Forest Research Institute *Silava*.

Projections of GHG emissions from the agriculture sector in Latvia are compiled by Latvia University of Life Sciences and Technologies experts according to 2006 IPCC Guidelines.

6.3.4. Land Use, Land Use Change and Forestry

The main data source for land use and carbon stock changes is National forest inventory program. Other data sources and research data are used as supplementary data sources, for quality assurance purposes as well as to provide activity data for those sources which are not covered by the NFI program.

The NFI and research data are used to estimate time series for areas and gross increment. Mortality data are calculated on the base of the NFI data and mortality factors[92]. Distinction between forest land remaining forest land and areas converted to forest land is made according to the age of dominant species in forests on afforested land – if age of dominant species is less than zero in 1990, it is considered as land converted to forest, in other cases it is considered as forest land remaining forest land.

Changes of organic carbon in litter and soil organic matter in naturally dry and wet soils are assumed to be zero according to research data on carbon stock in forest soil in 2006 and 2012[93]. Carbon stock changes are reported separately on naturally dry and wet mineral and organic soils and drained mineral and organic soils. Conversion of forest stands on drained mineral or organic soil to naturally wet soil is accounted as rewetting.

The activity data for calculation of emissions due to incineration of harvesting residues in regenerative fellings was based on the study until 2010[94]. Now a questionnaire for private forest owners on utilization of harvesting residues is used[95]. According to this questionnaire in 2005-2009 about 7% of residues are left for incineration and in 2010-2016 – 4.13% of the residues are incinerated. In case of on site incineration of harvesting residues during commercial harvesting, all emissions also are applied to the forest land remaining forest land category, because no commercial felling takes place in young stands (younger than 20 years) on land converted to forest land.

Area of organic soils in cropland and grassland is reported according to the results of research project implemented by Lazdiņš et al. in 2016[96]. Area of cropland and grassland in LULUCF reporting is synchronized with Agriculture reporting, including recalculation of cultivated organic soils.

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[91]Priekulis L, Aboltins A., Laurs A., Melece L., Research in manure management in Latvia/14th International scientific conference "Engineering for rural development" : proceedings, Jelgava, Latvia, May 20 - 22, 2015 Latvia University of Life Sciences and Technologies. Faculty of Engineering. - Jelgava, 2015. - Vol.14, p.88-93, http://tf.llu.lv/conference/proceedings2015/Papers/015_Laurs.pdf

[92]Lazdiņš A. et al., Koksnes atmiruma novērtēšana dažāda vecuma, valdošās sugas un meža tipa audzēs un vēsturisko CO_2 piesaistes dzīvajā biomasā datu pārrēķināšana no 1990. gada, 2012

[93]Lazdiņš A. et al., Atbalsts klimata pētījumu programmai (Pārskats par projekta 2013. gada darba uzdevumu izpildi), 2013

[94]Līpiņš L, Assessment of wood resources and efficiency of wood utilization, 2004

[95]Lazdiņš A., Zariņš J., Meža ugunsgrēku un mežizstrādes atlieku dedzināšanas radītās siltumnīcefekta gāzu emisijas Latvijā, Referātu Tēzes, 2013, 133–137

[96]Lazdiņš A., Bārdule A., Butlers A., Lupiķis A., Okmanis M., Bebre I., Petaja G. 2016. Aramzemes un ilggadīgo zālāju apsaimniekošanas radīto siltumnīcefekta gāzu (SEG) emisiju un oglekļa dioksīda (CO_2) piesaistes uzskaites sistēmas pilnveidošana un atbilstošu metodisko risinājumu izstrādāšana (Improving the accounting system of CO_2 removals and GHG emissions due to management practices in cropland and grassland and development of methodological solutions). 2016. gada starpziņojums, No. 101115/S109, p. 123, https://drive.google.com/open?id=0Bxv4jQ_04jXZRExSMWhPMWhDNDg

6.3.4.1. Activity data

6.3.4.1.1. FOREST LAND

Calculations of carbon stock changes and GHG emissions in forest lands are based on activity data provided by the NFI (area, living biomass and dead wood) and Level I forest monitoring data (soil organic carbon). Area of organic soils in the forest lands is reported according to structure of distribution of the forest stand types. National statistics data (Central Statistical Bureau of Latvia, State forest service) are used to estimate commercial felling and forest wildfires related emissions and removals. The calculation of GHG emissions and CO_2 removals in historical forest lands is based mainly on research report "Elaboration of the model for calculation of the CO_2 removals and GHG emissions due to forest management"[97] and factors and coefficients elaborated within the scope of the research program on impact of forest management on GHG emissions and CO_2 removals[98].

6.3.4.1.2. CROPLAND

Area of cropland is estimated using remote sensing based research data on the base of the NFI[99]. Carbon stock change in living and dead woody biomass is based on activity data provided by the NFI. Area of organic soils in cropland remaining cropland is reported according to the results of research project implemented in 2016. Area of organic soil in land converted to cropland is calculated using different approach than in cropland remaining cropland – the values characteristic for initial land use are applied. Respectively, if share of organic soil in forest land remaining forest in 1990 is 22%, it is considered, that area of organic soil in forest land converted to cropland in 1990 is 22%[100].

6.3.4.1.3. GRASSLAND

Area of grassland is estimated using remote sensing based research data on the base of the NFI. Area of organic soils in grassland is reported according to the results of research project implemented in 2016. Figures of carbon stock change in living and dead woody biomass is based on activity data provided by the NFI. Mortality rate are taken directly from forest land assuming that mortality in grassland is equal to average mortality (in percent of increment of living biomass) in forest land in a particular year.

6.3.4.1.4. SETTLEMENTS

The total area of settlements is estimated according to the information provided by the NFI. According to the expert estimation, increase of area of settlements during last 20 years took place due to conversion of forest land. Increase of area of settlements (deforestation) is generally associated with road construction. All roads, including forest roads are reported in the settlements category; therefore, the deforested area is considerably higher than official statistics, where forest roads are not accounted as deforested area. Area of land converted to settlements is estimated by evaluation of vegetation index of the permanent and temporal NFI points (23 thousand plots across the country) in series of satellite images produced in 1990, 1995 and 2000. Final land use was considered according to empiric

[97]Lazdiņš A., Forest Data National Modelling Tool in Latvia, 2012; Lazdiņš A., Donis J., Strūve L., Latvia's National Methodology for Reference Level of Forest Management Activities (English Summary), 2012

[98]Lazdiņš et al., Mežsaimniecisko darbību ietekmes uz siltumnīcefekta gāzu emisijām un CO_2 piesaisti novērtējums, 2013

[99]Latvia's National Inventory Report Submission under UNFCCC and the Kyoto Protocol Common Reporting Formats 1990 – 2014, Riga: Ministry of Environmental Protection and Regional Development of the Republic of Latvia, 2016.

[100]Lazdiņš A., Bārdule A., Stola J., Preliminary results of evaluation of area of organic soils in arable lands in Latvia

data obtained during field visits (2009-2013). CO_2 removals in living and dead biomass in settlements are accounted using the NFI data.

6.3.4.1.5. WETLANDS

Total area of wetlands is reported according to the research results, including 27.0 kha of peatlands drained for peat extraction (Table 3a.3.3[101]).

6.3.4.2. Methodologies and emission factors

Methodologies for calculating GHG emission projections for LULUCF are based on the 2018 National GHG inventory report. Carbon stock changes in living and dead biomass is calculated using tier 3 methodology (integrated AGM and EPIM models), soil carbon stock changes in mineral soils is estimated using tier 3 methodology – Yasso model; however, not reported as not a source due to high uncertainty of estimates. Carbon stock changes in organic soils in forest lands is reported using tier 2 method relaying on country specific emission factor; carbon stock changes in organic soils in other land uses,as well as emissions of N_2O and CH_4 from organic soils are reported using default emission factors (IPCC Wetlands Supplement). GHG emissions due to wildfires and incineration of harvesting residues are reported using country specific activity data and default emission factors (2006 IPCC Guidelines).

6.3.5. Waste management

6.3.5.1. Solid waste disposal

Two separate IPCC waste model 2006 calculations were used. One for unmanaged sites (closed dumpsites) and other for managed (landfills since 2002). For unmanaged sites calculation method for bulk wastes was used, because there are no correct information about disposed waste content available. According to Ltd Virsma research 2011 – DOC factor for these calculations was used as 0.17. Other factors are default from IPCC guidelines.

For managed sites method “waste by composition” in IPCC Waste model 2006 was used. DOC and k values and other factors are taken from 2006 IPCC Guidelines. Waste composition is taken from Ltd Virsma research 2011 (Table 6.22).

Table 6.22 Average waste composition in landfills in Latvia, %

	Paper	Plastics	Organic (food, hygiene waste, other organics)	Wood	Textile, rubber	Minerals (ceramics)	Glass	Metals
Average in Country	6.40	8.54	47.90	2.11	3.35	8.69	20.64	2.36

6.3.5.2. Composting

Projected CH_4 and N_2O emissions from composting are calculated according to 2006 IPCC Guidelines. Emission factors are multiplied with composted waste amounts. Composted waste amount in households is projected according to changes in population, but industrially composted amounts are

[101] Penman J. et.al., IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry, 2003.

projected according to time series from 2003 till 2016. From year 2020 increase of industrial composted amounts (about 100 000 tonns) is projected due to information about direct investments in Latvia waste companies.

6.3.5.3. Waste water handling

Following approaches were used for projections of activity data to estimate projected emissions of GHG from waste water handling sector:

- For CH_4 emissions from domestic/commercial waste water handling subsector:
  - Forecasts of national population;
  - Expected distribtuion of national population by type and level of treatment, based on historical trends and requirements of UWWTD;
  - Projections of sewage sludge production based on its correlation with private consumption and historical trend of share of anaerobic sludge.
- For N_2O emissions from domestic/commercial waste water handling subsector:
  - Forecasts of national population;
  - Expected rate of national population served by modern centralized treatment plants, based on historical trends and requirements of UWWTD.
- For CH_4 and N_2O emissions from industrial waste water handling subsector projections of emissions were extrapolated from the historical emission trends of this subsector.

Based on projected activity data emission projections were calculated according to 2006 IPCC Guidelines. Country-specific emission factors were used to calculate CH_4 emissions, but for emissions of N_2O default IPCC emission factors were used. No changes in emission factors were made for emission projections.

6.3.6. Changes compared to the Third Biennial Report

The models used for the preparation the projections of the Fourth Biennial Report are basically the same as those used for the Third Biennial Report.

7. PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY- BUILDING SUPPORT TO DEVELOPING COUNTRY PARTIES

This section includes information on the provision of financial, technological and capacity-building support to developing countries by Latvia.

Support to developing countries plays an important role in reaching the agreed goal of limiting the global average temperature increase to below 2°C above pre-industrial levels, achieving the transformation to low GHG emissions economies, and supporting climate- resilient sustainable development. Developed countries have committed to a long-term goal of jointly mobilizing USD 100 billion per year by 2020. This pledge has helped to significantly scale up climate finance. At the same time, it should be emphasized that Latvia, as well as some of the other EU Member States due to strict budgetary constraints have limited opportunities to participate in the financing of climate change and to support developing countries. As regards of scaling up climate finance, Latvia would like to acknowledge that an essential factor is the leverage of private finance. Private finance and investment will be pivotal to achieving long-term transformation of developing countries into low-carbon, sustainable, and climate-resilient economies.

Latvia is not an Annex II Party therefore the provisions of United Nations Framework Convention on Climate Change Article 4.3, 4.4 and 4.5 are not applicable, but it was decided to report provision of financial support according to EU Regulation No.525/2013 of the European Parliament and of the Council on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision no. 280/2004/EC.

Despite limited resources, Latvia contributed 350 000 EUR to the Green Climate Fund at the end of December, 2014. Between 2011 and 2016, Latvia also contributed in total of 85 000 EUR to the Eastern Europe Energy Efficiency and Environment partnership Fund (E5P).

Regarding capacity-building Latvia has engaged in bilateral cooperation with Uzbekistan in 2017 and 2018. In 2017 "Cleantech Latvia" association implemented the project “Support of the Latvian Clean Technology Cluster Cleantech Latvia for the Capacity Building of Regional Municipalities (hakimat) in Rural Areas of Uzbekistan” with the financing of the Ministry of Foreign Affairs of the Republic of Latvia (MFA) in the amount of 24 993 EUR. During the project, training was carried out for 3 municipal experts from Uzbekistan's regional authorities (hakimat) - Bukhara, Navoji and Karsh - to promote sustainable growth in the regions. The training courses were based on the development needs of each specific region, but focused on 5 key topics - sustainable environmental planning, water management, municipal waste management and recycling, eco-friendly urban and regional environmental planning, bio-waste recycling for further use (including solutions for the recycling of agricultural and other biowaste using biogas and cogeneration).

In 2018, “Cleantech Latvia” continued its cooperation with Uzbekistan within another project - “Capacity Building for Sustainable Development in Uzbekistan's Public Administration” with MFA funding of 39 437 EUR. The project included training and consultations on energy efficiency, alternative energy and sustainable and safe agriculture for responsible officials and specialists involved in public

administration in order to increase their capacity and raise awareness of the importance of sustainable development in improving the national economy.

Latvia intends to continue the work on the support to developing countries in the future including bilateral channels.

Summarized information on the financial and provision of capacity – building support can be found in the CTF Tables 7 and 9 included also in the Annex of Latvia's Fourth Biennial Report. The technology support and transfer were not provisioned, therefore in the Annex of Latvia's Fourth Biennial Report the CTF Table 8 is not presented.

DESCRIPTION OF IMPLEMENTED MODELS FOR GHG PROJECTIONS

Model	Gases and/sector	Type of model/approach and characteristics	Original purpose and changes to climate change purposes	Strengths and weaknesses of the model/approach	Overlap or synergies with PAM
MARKAL-Latvia	*All GHG and air pollution emissions* *Energy and Transport*	*Partial equilibrium, bottom-up, optimization model. It is used Elastic demand approach.* *Additional information can be found at: http://www.iea-etsap.org/web/Markal.asp*	*Original purpose is to describe development of the Latvian energy system over a period of 50 years on the national level.* *The model structure is adapted, so that emissions can be calculated and reported not only by the type of fuel, but also by sector and corresponding type of technologies. Model is developed to investigate impact of specific policies (energy efficiency and RES) to GHG emissions.*	*Strength:* *Well understood least-cost modelling paradigm (efficient markets);* *Provides a framework to evaluate technologies on the basis of cost assumptions, to check the consistency of results and explore sensitivities to key data and assumptions;* *Transparent framework; open assumptions on data, technology pathways, constraints etc;* *Interactions within entire energy system (e.g. resource supply curves, competing use for infrastructures and fuels, sectoral technology diffusion);* *Ability to track emissions and energy consumption across the energy system, and model the impact of constraints on both;* *Weaknesses:* *Model is highly data intensive (characterization of technologies and RES);* *Limited ability to model consumers' behaviour;*	*Considering that MARKAL model is optimisation model, the impact assessment of defined PAMs might be done without overlapping. The MARKAL model chooses the PaMs according the least cost order (e.g., at first it is chosen the energy efficiency measures having lower costs which are followed by the higher costs' RES measures). Thus as the result, the integrated evaluation of energy system is performed.* *To minimise the risk of overlapping the GHG savings from PaMs a package approach has been adopted when accounting for the impact of policies on emissions.*

Model	Gases and/sector	Type of model/approach and characteristics	Original purpose and changes to climate change purposes	Strengths and weaknesses of the model/approach	Overlap or synergies with PAM
F-gases Excel based accounting model	*HFC and SF6 CRF 2.F Product uses as substitutes for ODS; CRF 2.G Other product manufacture and use.*	*Accounting model: Top-down accounting model is based on 2006 IPCC guidelines and adjusted for projection estimation incorporating parameters according to macroeconomic forecast.*	*The F-gases accounting model originally was designed for F-gases emission calculation in annual GHG inventory.*	*Strength:* *As the one model is used for F-gases emission calculation in both GHG inventory and for estimation of projections hence the consistency is ensured* *Weakness:* *Susceptible to trivial human errors.*	*In purpose to avoid the overlapping that may exist between different policies and measures (PaMs) the analyse of PaMs is carried out before including them into WEM or WAM scenario. Afterwards measures are grouped and combined by the type of their effect.*
IPCC Waste model and Excel based estimation of activity data	*All GHG and air pollution emissions CRF 5 Waste*	*IPCC Waste model: bottom up approach.* *Emission projection estimations based on IPCC methodology. Estimations of activity data are based on macroeconomic forecast, existing trends and existing/planned PaMs in the sector.*	*IPCC Waste model was originally designed for estimation of CH_4 emission from solid waste disposal.*	*Strength:* *IPCC Waste model: Comparability with calculations from other countries.* *Excel based estimations: simplicity and flexibility.* *Weakness:* *IPCC Waste model: Low flexibility if parameters are changing due to time series.* *Excel based estimations: Susceptible to trivial human errors in interpretation of existing or projected trends in the sector.*	*Existing and planned PaMs are taken into account in order to estimate relevant activity data for emission projections.*
IPCC AFOLU model and Excel or R based estimation of activity data	*All GHG and air pollution emissions CRF 3 Agriculture.*	*IPCC AFOLU model: bottom up approach.* *Emission projection estimations are based on IPCC methodology. Estimations of activity data are based on forecast of milk and grain price; as well as on existing trends of agricultural sector activity data.*	*IPCC AFOLU model was originally designed for estimation of CH4 and N2O emissions from enteric fermentation, manure and soil management.*	*Strength:* *IPCC AFOLU model: Comparability of calculations for inventory and providing of calculation consistency.* *Weakness:* *Regression based estimation of activity data is done by*	*Existing PaMs are evaluated in order to estimate relevant emission projections by using IPCC methodology.*

Model	Gases and/sector	Type of model/approach and characteristics	Original purpose and changes to climate change purposes	Strengths and weaknesses of the model/approach	Overlap or synergies with PAM
				using different sources of macroeconomic indicators, low flexibility in relation to existing PaMs.	

CTF ANNEX: COMMON TABULAR FORMAT WORKBOOK FOR THE 4TH BIENNIAL REPORT

Contents

CTF Table 1: Emission trends

Table 1 LVA_BR4_v0.1

Emission trends: summary

(Sheet 1 of 3)

GREENHOUSE GAS EMISSIONS	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt CO_2 eq									
CO_2 emissions without net CO_2 from LULUCF	19,504.91	19,504.91	17,783.61	14,080.38	11,818.92	10,297.01	9,090.49	9,170.68	8,646.41	8,281.12
CO_2 emissions with net CO_2 from LULUCF	8,599.30	8,599.30	6,472.68	2,319.16	182.71	-4,242.31	-4,360.68	-4,548.46	-3,379.71	-2,853.74
CH_4 emissions without CH_4 from LULUCF	3,537.27	3,537.27	3,482.25	2,994.69	2,273.19	2,103.38	2,087.52	2,050.23	2,022.66	1,937.21
CH_4 emissions with CH_4 from LULUCF	4,036.32	4,036.32	3,974.10	3,564.38	2,765.60	2,591.55	2,582.96	2,545.54	2,518.38	2,431.31
N_2O emissions without N_2O from LULUCF	3,217.28	3,217.28	3,099.68	2,541.45	2,107.55	1,868.87	1,712.61	1,710.60	1,709.78	1,657.13
N_2O emissions with N_2O from LULUCF	3,794.92	3,794.92	3,677.00	3,128.61	2,686.61	2,447.93	2,293.01	2,292.63	2,292.81	2,242.05
HFCs	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	2.50	2.76	3.35	7.60
PFCs	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Unspecified mix of HFCs and PFCs	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
SF_6	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.17	0.18	0.37	0.52
NF3	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Total (without LULUCF)	26,259.46	26,259.46	24,365.54	19,616.51	16,199.65	14,269.26	12,893.29	12,934.45	12,382.56	11,883.59
Total (with LULUCF)	16,430.54	16,430.54	14,123.77	9,012.15	5,634.92	797.17	517.96	292.66	1,435.20	1,827.74
Total (without LULUCF, with indirect)	26,299.76	26,299.76	24,403.88	19,652.28	16,233.39	14,302.42	12,925.45	12,965.29	12,411.51	11,911.01
Total (with LULUCF, with indirect)	16,470.84	16,470.84	14,162.11	9,047.92	5,668.66	830.33	550.12	323.50	1,464.15	1,855.16
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt CO_2 eq									
1. Energy	19,288.96	19,288.96	17,830.83	14,463.48	12,363.06	10,698.11	9,463.06	9,531.58	8,966.75	8,557.85
2. Industrial processes and product use	654.31	654.31	586.70	306.42	147.99	195.34	210.92	221.96	238.01	246.72
3. Agriculture	5,616.57	5,616.57	5,215.75	4,150.70	3,064.03	2,763.06	2,595.97	2,552.30	2,530.99	2,420.83
4. Land Use, Land-Use Change and Forestry[b]	-9,828.92	-9,828.92	-10,241.77	-10,604.36	-10,564.73	-13,472.09	-12,375.33	-12,641.79	-10,947.36	-10,055.85
5. Waste	699.62	699.62	732.26	695.93	624.58	612.75	623.34	628.61	646.81	658.18
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)	16,430.54	16,430.54	14,123.77	9,012.15	5,634.92	797.17	517.96	292.66	1,435.20	1,827.74

Notes: All footnotes for this table are given on sheet 3 of table 1

Table 1
Emission trends: summary
(Sheet 2 of 3)

GREENHOUSE GAS EMISSIONS	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CO_2 emissions without net CO_2 from LULUCF	7,696.47	7,065.17	7,475.00	7,508.67	7,727.96	7,738.03	7,812.76	8,313.84	8,635.77	8,197.12	7,457.35
CO_2 emissions with net CO_2 from LULUCF	128.54	-2,782.31	-3,128.64	-1,365.99	-726.94	2,961.94	3,593.46	3,378.03	3,403.78	2,503.32	4,409.58
CH_4 emissions without CH_4 from LULUCF	1,806.48	1,808.05	1,887.54	1,861.16	1,768.43	1,738.80	1,787.44	1,745.79	1,794.48	1,755.10	1,764.78
CH_4 emissions with CH_4 from LULUCF	2,327.03	2,313.38	2,355.67	2,353.94	2,238.24	2,200.50	2,223.56	2,221.02	2,223.67	2,179.79	2,204.98
N_2O emissions without N_2O from LULUCF	1,588.12	1,599.58	1,680.35	1,649.33	1,696.97	1,686.00	1,728.95	1,732.10	1,790.57	1,774.88	1,791.43
N_2O emissions with N_2O from LULUCF	2,176.99	2,190.32	2,270.06	2,245.56	2,293.74	2,284.59	2,327.17	2,339.96	2,393.05	2,378.48	2,397.53
HFCs	10.57	14.08	17.89	21.66	25.50	40.70	55.00	87.99	114.05	141.65	155.27
PFCs	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Unspecified mix of HFCs and PFCs	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
SF_6	0.71	0.88	1.39	2.62	2.76	3.25	3.78	4.07	4.55	5.23	7.33
NF3	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Total (without LULUCF)	11,102.35	10,487.76	11,062.16	11,043.44	11,221.62	11,206.79	11,387.93	11,883.79	12,339.42	11,873.99	11,176.16
Total (with LULUCF)	4,643.84	1,736.35	1,516.37	3,257.79	3,833.30	7,490.98	8,202.97	8,031.07	8,139.10	7,208.47	9,174.70
Total (without LULUCF, with indirect)	11,129.00	10,512.46	11,086.27	11,068.30	11,241.39	11,226.07	11,409.15	11,900.09	12,357.37	11,891.53	11,192.83
Total (with LULUCF, with indirect)	4,670.49	1,761.05	1,540.48	3,282.66	3,853.07	7,510.27	8,224.19	8,047.38	8,157.06	7,226.01	9,191.37
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Energy	7,926.41	7,313.32	7,730.49	7,739.51	7,918.15	7,947.89	8,054.42	8,491.47	8,822.28	8,363.19	7,649.57
2. Industrial processes and product use	282.38	234.55	260.16	274.67	292.41	325.56	319.54	377.53	403.76	419.04	421.37
3. Agriculture	2,226.46	2,248.85	2,363.34	2,339.51	2,384.94	2,314.99	2,384.47	2,384.87	2,476.74	2,447.39	2,459.24
4. Land Use, Land-Use Change and Forestry[b]	-6,458.51	-8,751.41	-9,545.79	-7,785.65	-7,388.32	-3,715.81	-3,184.96	-3,852.72	-4,200.31	-4,665.52	-2,001.46
5. Waste	667.10	691.04	708.16	689.75	626.11	618.35	629.50	629.92	636.64	644.36	645.97
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)	4,643.84	1,736.35	1,516.37	3,257.79	3,833.30	7,490.98	8,202.97	8,031.07	8,139.10	7,208.47	9,174.70

Notes: All footnotes for this table are given on sheet 3 of table 1.

Table 1
Emission trends: summary

(Sheet 3 of 3)

GREENHOUSE GAS EMISSIONS	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
									(%)
CO_2 emissions without net CO_2 from LULUCF	8,553.97	7,809.54	7,519.81	7,385.15	7,188.27	7,278.85	7,232.33	7,235.24	-62.91
CO_2 emissions with net CO_2 from LULUCF	7,580.26	6,755.06	4,382.83	4,978.12	9,115.95	7,853.57	5,790.12	4,377.56	-49.09
CH_4 emissions without CH_4 from LULUCF	1,728.91	1,683.25	1,726.78	1,759.03	1,815.94	1,728.11	1,778.76	1,804.63	-48.98
CH_4 emissions with CH_4 from LULUCF	2,173.52	2,136.87	2,191.38	2,237.25	2,313.33	2,235.39	2,298.33	2,337.87	-42.08
N_2O emissions without N_2O from LULUCF	1,822.94	1,817.89	1,897.15	1,915.83	1,954.60	2,019.29	2,006.91	2,021.09	-37.18
N_2O emissions with N_2O from LULUCF	2,429.68	2,425.79	2,506.51	2,526.96	2,568.55	2,634.13	2,623.08	2,638.67	-30.47
HFCs	166.06	171.24	175.95	191.21	206.11	219.56	240.84	234.92	100.00
PFCs	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00
Unspecified mix of HFCs and PFCs	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00
SF_6	7.35	7.47	7.78	8.50	8.58	10.12	9.89	10.32	100.00
NF3	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00
Total (without LULUCF)	12,279.23	11,489.40	11,327.46	11,259.72	11,173.49	11,255.92	11,268.72	11,306.20	-56.94
Total (with LULUCF)	12,356.86	11,496.44	9,264.45	9,942.04	14,212.52	12,952.76	10,962.25	9,599.35	-41.58
Total (without LULUCF, with indirect)	12,295.27	11,500.13	11,339.98	11,275.18	11,194.04	11,272.95	11,286.49	11,325.33	-56.94
Total (with LULUCF, with indirect)	12,372.89	11,507.18	9,276.97	9,957.49	14,233.07	12,969.78	10,980.02	9,618.48	-41.60

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
									(%)
1. Energy	8,448.13	7,576.04	7,266.86	7,214.04	7,045.31	7,169.06	7,245.73	7,225.19	-62.54
2. Industrial processes and product use	700.31	801.06	863.86	809.34	824.71	755.16	655.88	733.48	12.10
3. Agriculture	2,480.26	2,486.36	2,581.39	2,632.60	2,705.31	2,769.93	2,766.31	2,782.32	-50.46
4. Land Use, Land-Use Change and Forestry[b]	77.63	7.04	-2,063.01	-1,317.68	3,039.03	1,696.83	-306.47	-1,706.85	-82.63
5. Waste	650.54	625.93	615.35	603.74	598.16	561.77	600.80	565.21	-19.21
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Total (including LULUCF)	12,356.86	11,496.44	9,264.45	9,942.04	14,212.52	12,952.76	10,962.25	9,599.35	-41.58

Further detailed information could be found in the common reporting format tables of the Party's greenhouse gas inventory, namely "Emission trends (CO_2)", "Emission trends (CH_4)", "Emission trends (N_2O)" and "Emission trends (HFCs, PFCs and SF_6)", which is included in an annex to this biennial report.
1 kt CO_2 eq. equals 1 Gg CO_2 eq.
Abbreviation: LULUCF = land use, land-use change and forestry.
[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

Table 1(a)

LVA_BR4_v0.1

Emission trends (CO_2)

(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*Base year[a]*	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
1. Energy	18,488.51	18,488.51	16,969.94	13,740.37	11,669.55	10,101.72	8,882.74	8,952.52	8,413.13	8,041.50
A. Fuel combustion (sectoral approach)	18,488.49	18,488.49	16,969.93	13,740.36	11,669.54	10,101.71	8,882.73	8,952.51	8,413.12	8,041.49
1. Energy industries	6,227.91	6,227.91	5,719.98	4,882.05	3,953.63	3,735.04	3,408.66	3,537.53	3,298.53	3,360.62
2. Manufacturing industries and construction	3,902.03	3,902.03	2,938.75	2,488.00	2,150.37	1,942.96	1,901.97	1,858.96	1,800.45	1,569.87
3. Transport	2,940.78	2,940.78	2,754.66	2,457.45	2,265.96	2,149.87	2,047.99	2,013.63	2,005.80	1,981.27
4. Other sectors	5,417.78	5,417.78	5,556.54	3,912.86	3,299.58	2,273.85	1,524.11	1,542.20	1,308.24	1,129.55
5. Other	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	0.19	0.10	0.19
B. Fugitive emissions from fuels	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
C. CO_2 transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial processes	650.99	650.99	583.41	303.16	144.80	192.20	205.16	215.98	231.25	235.59
A. Mineral industry	537.24	537.24	493.54	226.26	61.17	108.06	126.57	138.83	139.53	139.70
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	69.56	69.56	54.30	43.26	47.98	50.04	45.38	44.16	60.14	62.66
D. Non-energy products from fuels and solvent use	44.19	44.19	35.57	33.64	35.65	34.11	33.21	32.99	31.58	33.23
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
3. Agriculture	364.84	364.84	229.66	36.23	3.93	2.43	1.91	1.49	1.32	3.30
A. Enteric fermentation										
B. Manure management										
C. Rice cultivation										
D. Agricultural soils										
E. Prescribed burning of savannas										
F. Field burning of agricultural residues										
G. Liming	357.13	357.13	223.07	32.36	1.60	0.73	1.24	0.64	0.18	2.15
H. Urea application	7.71	7.71	6.59	3.87	2.33	1.70	0.67	0.85	1.14	1.15
I. Other carbon-containing fertilizers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land Use, Land-Use Change and Forestry	-10,905.61	-10,905.61	-11,310.93	-11,761.22	-11,636.21	-14,539.32	-13,451.16	-13,719.13	-12,026.12	-11,134.86
A. Forest land	-17,405.29	-17,405.29	-18,191.40	-17,801.81	-17,685.58	-20,138.95	-18,619.66	-18,591.72	-15,995.98	-14,554.56
B. Cropland	3,466.75	3,466.75	3,415.78	3,365.15	3,314.84	3,264.04	3,237.41	3,210.81	3,184.21	3,157.64
C. Grassland	1,963.71	1,963.71	1,948.81	1,932.83	1,911.85	1,894.97	1,864.80	1,821.06	1,782.17	1,739.91
D. Wetlands	1,267.85	1,267.85	1,710.69	716.46	452.05	563.00	573.54	562.24	606.18	523.42
E. Settlements	-32.51	-32.51	-32.10	-31.03	-27.21	-26.19	-33.22	-30.71	-30.29	-26.98
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products	-166.13	-166.13	-162.71	57.19	397.85	-96.18	-474.04	-690.82	-1,572.42	-1,974.29

H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	0.57	0.57	0.59	0.61	0.63	0.65	0.67	0.69	0.71	0.73
A. Solid waste disposal	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
B. Biological treatment of solid waste										
C. Incineration and open burning of waste	0.57	0.57	0.59	0.61	0.63	0.65	0.67	0.69	0.71	0.73
D. Waste water treatment and discharge										
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:										
International bunkers	1,736.63	1,736.63	752.16	659.67	763.98	972.68	559.54	411.51	326.60	137.90
Aviation	221.15	221.15	299.01	84.10	84.10	77.87	77.87	99.67	99.67	90.33
Navigation	1,515.49	1,515.49	453.15	575.57	679.88	894.81	481.67	311.84	226.93	47.57
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO_2 emissions from biomass	3,024.52	3,024.52	3,547.13	3,537.13	3,941.03	4,085.61	4,631.25	4,841.29	4,852.53	4,789.23
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Long-term storage of C in waste disposal sites	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indirect N_2O										
Indirect CO_2 (3)	40.30	40.30	38.34	35.76	33.74	33.16	32.16	30.84	28.95	27.42
Total CO_2 equivalent emissions without land use, land-use change and forestry	19,504.91	19,504.91	17,783.61	14,080.38	11,818.92	10,297.01	9,090.49	9,170.68	8,646.41	8,281.12
Total CO_2 equivalent emissions with land use, land-use change and forestry	8,599.30	8,599.30	6,472.68	2,319.16	182.71	-4,242.31	-4,360.68	-4,548.46	-3,379.71	-2,853.74
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry	19,545.21	19,545.21	17,821.95	14,116.14	11,852.66	10,330.17	9,122.65	9,201.52	8,675.35	8,308.55
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry	8,639.60	8,639.60	6,511.02	2,354.92	216.45	-4,209.15	-4,328.52	-4,517.61	-3,350.77	-2,826.31

Notes:

All footnotes for this table are given on sheet 3 of table 1(a).

Table 1(a)
Emission trends (CO_2)
(Sheet 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Energy	7,424.24	6,841.33	7,232.51	7,241.33	7,440.23	7,456.39	7,551.43	8,026.83	8,345.84	7,921.10	7,193.06
A. Fuel combustion (sectoral approach)	7,424.24	6,841.32	7,232.50	7,241.33	7,440.22	7,456.39	7,551.43	8,026.82	8,345.83	7,921.10	7,193.06
1. Energy industries	2,937.87	2,488.76	2,433.45	2,329.49	2,259.49	2,068.05	2,057.91	2,084.56	1,954.33	1,926.53	1,876.50
2. Manufacturing industries and construction	1,420.38	1,155.18	1,053.84	1,103.20	1,123.42	1,136.91	1,142.47	1,213.09	1,207.36	1,100.29	874.74
3. Transport	1,949.36	2,160.73	2,556.52	2,634.66	2,779.79	2,920.32	3,047.31	3,363.26	3,805.79	3,594.27	3,151.44
4. Other sectors	1,116.47	1,036.52	1,188.53	1,167.10	1,271.35	1,321.48	1,296.12	1,358.40	1,375.51	1,296.60	1,285.04
5. Other	0.15	0.14	0.17	6.88	6.16	9.63	7.62	7.51	2.84	3.41	5.34
B. Fugitive emissions from fuels	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
C. CO2 transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial processes	268.12	216.63	237.95	247.50	261.28	278.76	257.95	282.68	282.40	269.60	255.61
A. Mineral industry	173.67	122.68	145.16	154.93	163.39	174.50	165.38	193.11	199.63	198.81	190.97
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	61.37	61.10	60.27	60.33	64.63	68.52	49.98	48.36	44.41	37.73	39.01
D. Non-energy products from fuels and solvent use	33.08	32.84	32.51	32.24	33.26	35.73	37.75	36.49	38.36	33.05	25.63
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	4.85	4.73	NO, NA	NO, NA	NO, NA
3. Agriculture	3.36	6.02	2.17	19.54	26.08	2.43	2.94	2.80	6.33	5.92	8.34
A. Enteric fermentation											
B. Manure management											
C. Rice cultivation											
D. Agricultural soils											
E. Prescribed burning of savannas											
F. Field burning of agricultural residues											
G. Liming	2.25	4.68	0.32	15.08	24.66	1.01	1.51	1.38	4.90	2.75	3.99
H. Urea application	1.11	1.35	1.85	4.46	1.42	1.42	1.43	1.43	1.43	3.17	4.35
I. Other carbon-containing fertilizers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land Use, Land-Use Change and Forestry	-7,567.94	-9,847.48	-10,603.64	-8,874.66	-8,454.90	-4,776.10	-4,219.31	-4,935.81	-5,231.98	-5,693.81	-3,047.77
A. Forest land	-10,976.36	-13,563.57	-14,479.99	-12,998.54	-12,470.32	-8,905.79	-8,473.87	-9,341.70	-9,201.55	-10,262.15	-7,377.51
B. Cropland	3,131.09	3,095.43	3,060.12	3,024.90	2,989.92	2,955.10	2,919.95	2,884.97	2,893.14	2,892.37	2,892.64
C. Grassland	1,699.92	2,179.44	2,158.73	2,140.12	2,126.27	2,109.61	2,091.41	2,074.51	1,435.79	1,389.22	1,342.46
D. Wetlands	909.10	739.07	830.66	1,157.86	1,060.27	1,089.42	1,300.92	1,529.25	964.83	1,284.76	1,263.11

E. Settlements	-24.53	58.43	71.00	83.74	96.55	109.14	121.98	134.52	47.46	54.85	64.58
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products	-2,307.15	-2,356.28	-2,244.17	-2,282.74	-2,257.58	-2,133.58	-2,179.69	-2,217.35	-1,371.65	-1,052.84	-1,233.04
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	0.75	1.19	2.36	0.30	0.37	0.45	0.44	1.53	1.20	0.51	0.34
A. Solid waste disposal	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
B. Biological treatment of solid waste											
C. Incineration and open burning of waste	0.75	1.19	2.36	0.30	0.37	0.45	0.44	1.53	1.20	0.51	0.34
D. Waste water treatment and discharge											
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:											
International bunkers	122.09	106.39	703.41	740.59	721.02	794.17	1,011.39	831.32	815.44	955.60	1,189.41
Aviation	90.33	80.98	80.98	84.10	121.50	147.44	178.76	200.64	244.67	294.17	310.61
Navigation	31.76	25.41	622.43	656.49	599.52	646.73	832.64	630.68	570.77	661.43	878.80
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO_2 emissions from biomass	4,702.89	4,370.68	4,880.83	4,850.23	5,149.69	5,430.64	5,437.83	5,477.51	5,354.97	5,072.54	5,797.79
CO_2 captured	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO
Long-term storage of C in waste disposal sites	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indirect N_2O											
Indirect CO_2 (3)	26.64	24.70	24.11	24.86	19.77	19.28	21.22	16.31	17.95	17.54	16.68
Total CO_2 equivalent emissions without land use, land-use change and forestry	7,696.47	7,065.17	7,475.00	7,508.67	7,727.96	7,738.03	7,812.76	8,313.84	8,635.77	8,197.12	7,457.35
Total CO_2 equivalent emissions with land use, land-use change and forestry	128.54	-2,782.31	-3,128.64	-1,365.99	-726.94	2,961.94	3,593.46	3,378.03	3,403.78	2,503.32	4,409.58
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry	7,723.12	7,089.87	7,499.11	7,533.53	7,747.73	7,757.31	7,833.98	8,330.15	8,653.72	8,214.66	7,474.03
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry	155.18	-2,757.61	-3,104.53	-1,341.12	-707.17	2,981.22	3,614.68	3,394.34	3,421.74	2,520.85	4,426.26

Notes:

All footnotes for this table are given on sheet 3 of table 1(a).

Emission trends (CO_2)
(Sheet 3 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
									%
1. Energy	8,023.89	7,178.14	6,827.07	6,761.23	6,557.50	6,730.61	6,799.93	6,716.51	-63.67
A. Fuel combustion (sectoral approach)	8,023.88	7,178.13	6,827.07	6,761.22	6,557.49	6,730.60	6,799.92	6,716.49	-63.67
1. Energy industries	2,260.39	2,081.30	1,863.79	1,931.15	1,670.84	1,746.97	1,822.83	1,511.16	-75.74
2. Manufacturing industries and construction	1,071.45	869.78	914.55	768.04	696.94	645.70	581.31	623.56	-84.02
3. Transport	3,220.99	2,859.24	2,756.42	2,793.06	2,915.83	3,095.54	3,120.16	3,272.70	11.29
4. Other sectors	1,463.19	1,360.59	1,284.99	1,262.51	1,264.43	1,232.82	1,264.23	1,295.90	-76.08
5. Other	7.87	7.22	7.33	6.45	9.44	9.57	11.39	13.17	100.00
B. Fugitive emissions from fuels	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.02	36.45
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	0.00
2. Oil and natural gas and other emissions from energy production	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.02	36.45
C. CO_2 transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	0.00
2. Industrial processes	523.76	618.83	676.71	606.17	606.55	521.91	401.69	484.54	-25.57
A. Mineral industry	452.96	569.00	586.96	553.79	571.51	479.57	356.11	447.25	-16.75
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C. Metal industry	38.64	13.71	53.34	13.88	0.01	0.81	NO	NO	
D. Non-energy products from fuels and solvent use	32.16	36.12	36.42	38.50	35.02	41.53	45.58	37.29	-15.63
E. Electronic industry									
F. Product uses as ODS substitutes									
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	0.00
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
3. Agriculture	5.97	12.23	15.69	17.32	23.66	26.15	30.53	33.90	-90.71
A. Enteric fermentation									
B. Manure management									
C. Rice cultivation									
D. Agricultural soils									
E. Prescribed burning of savannas									
F. Field burning of agricultural residues									
G. Liming	1.97	7.98	9.90	13.25	18.93	19.94	22.60	24.43	-93.16
H. Urea application	4.00	4.25	5.79	4.08	4.73	6.21	7.93	9.48	22.92
I. Other carbon-containing fertilizers	NE	NE	NE	NE	NE	NE	NE	NE	0.00
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
4. Land Use, Land-Use Change and Forestry	-973.71	-1,054.48	-3,136.98	-2,407.03	1,927.69	574.72	-1,442.21	-2,857.68	-73.80
A. Forest land	-4,523.66	-4,597.92	-5,839.59	-5,541.16	-915.31	-2,555.71	-3,834.03	-5,808.30	-66.63
B. Cropland	2,891.18	2,889.28	2,821.53	2,818.68	2,815.74	2,812.05	2,809.00	2,883.52	-16.82
C. Grassland	1,296.25	1,251.19	1,180.77	1,137.32	1,097.00	1,061.79	1,025.92	893.52	-54.50
D. Wetlands	1,122.54	1,367.00	1,208.64	1,698.67	1,373.59	1,683.66	1,275.51	1,437.56	13.39
E. Settlements	72.36	80.05	-612.35	-604.34	-592.88	-585.06	-574.65	-28.09	-13.58
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	0.00

G. Harvested wood products	-1,832.38	-2,044.07	-1,895.96	-1,916.20	-1,850.45	-1,842.02	-2,143.96	-2,235.89	1,245.86
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
5. Waste	0.34	0.34	0.32	0.43	0.56	0.18	0.17	0.29	-50.22
A. Solid waste disposal	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NO, NA	NO, NA	0.00
B. Biological treatment of solid waste									
C. Incineration and open burning of waste	0.34	0.34	0.32	0.43	0.56	0.18	0.17	0.29	-50.22
D. Waste water treatment and discharge									
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Memo items:									
International bunkers	1,163.15	1,044.60	1,131.73	1,124.22	1,076.76	1,138.40	1,375.08	1,253.66	-27.81
Aviation	356.36	357.45	362.04	373.58	332.82	326.70	371.73	425.70	92.50
Navigation	806.79	687.15	769.70	750.64	743.94	811.70	1,003.35	827.96	-45.37
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	0.00
CO_2 emissions from biomass	5,153.64	5,388.82	6,038.43	6,094.47	6,460.21	6,121.14	6,242.85	6,588.39	117.83
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Long-term storage of C in waste disposal sites	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Indirect N_2O									
Indirect CO_2 (3)	16.03	10.74	12.52	15.45	20.55	17.02	17.76	19.13	-52.53
Total CO_2 equivalent emissions without land use, land-use change and forestry	8,553.97	7,809.54	7,519.81	7,385.15	7,188.27	7,278.85	7,232.33	7,235.24	-62.91
Total CO_2 equivalent emissions with land use, land-use change and forestry	7,580.26	6,755.06	4,382.83	4,978.12	9,115.95	7,853.57	5,790.12	4,377.56	-49.09
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry	8,570.00	7,820.28	7,532.33	7,400.60	7,208.82	7,295.87	7,250.09	7,254.37	-62.88
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry	7,596.29	6,765.80	4,395.35	4,993.57	9,136.50	7,870.59	5,807.88	4,396.69	-49.11

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[b] Fill in net emissions/removals as reported in CRF table Summary 1.A of the latest reported inventory year. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

Emission trends (CH_4)
(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
1. Energy	19.87	19.87	20.31	18.23	18.37	18.06	18.00	17.91	16.90	15.76
A. Fuel combustion (sectoral approach)	9.97	9.97	10.77	9.53	10.06	9.93	10.08	10.28	9.78	8.93
1. Energy industries	0.19	0.19	0.17	0.15	0.14	0.15	0.12	0.15	0.19	0.21
2. Manufacturing industries and construction	0.24	0.24	0.13	0.12	0.15	0.15	0.14	0.15	0.15	0.16
3. Transport	0.76	0.76	0.70	0.66	0.63	0.60	0.55	0.53	0.50	0.47
4. Other sectors	8.78	8.78	9.77	8.60	9.14	9.03	9.26	9.45	8.94	8.09
5. Other	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	0.00	0.00	0.00
B. Fugitive emissions from fuels	9.90	9.90	9.54	8.70	8.32	8.13	7.92	7.63	7.12	6.83
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	9.90	9.90	9.54	8.70	8.32	8.13	7.92	7.63	7.12	6.83
C. CO_2 transport and storage										
2. Industrial processes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Mineral industry										
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Non-energy products from fuels and solvent use	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
3. Agriculture	96.45	96.45	92.50	76.51	50.25	44.10	42.99	41.14	40.26	37.46
A. Enteric fermentation	88.86	88.86	85.25	70.62	46.23	40.42	39.16	37.67	36.83	34.18
B. Manure management	7.59	7.59	7.25	5.89	4.02	3.68	3.83	3.47	3.42	3.28
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming										
H. Urea application										
I. Other carbon-containing fertilizers										
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	19.96	19.96	19.67	22.79	19.70	19.53	19.82	19.81	19.83	19.76
A. Forest land	4.82	4.82	4.64	7.86	4.91	4.85	5.26	5.42	5.59	5.68
B. Cropland	6.99	6.99	6.88	6.78	6.67	6.57	6.50	6.43	6.36	6.30
C. Grassland	6.53	6.53	6.48	6.43	6.36	6.31	6.21	6.08	5.95	5.82
D. Wetlands	1.63	1.63	1.67	1.71	1.75	1.79	1.84	1.88	1.92	1.96
E. Settlements	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products										
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	25.16	25.16	26.48	25.05	22.31	21.97	22.52	22.96	23.75	24.27

A. Solid waste disposal	11.32	11.32	11.83	12.35	12.87	13.40	13.93	14.46	15.00	15.54
B. Biological treatment of solid waste	0.96	0.96	0.95	0.95	0.93	0.91	0.90	0.89	0.88	0.87
C. Incineration and open burning of waste	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
D. Waste water treatment and discharge	12.88	12.88	13.69	11.75	8.51	7.66	7.69	7.61	7.88	7.86
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CH_4 emissions without CH_4 from LULUCF	141.49	141.49	139.29	119.79	90.93	84.14	83.50	82.01	80.91	77.49
Total CH_4 emissions with CH_4 from LULUCF	161.45	161.45	158.96	142.58	110.62	103.66	103.32	101.82	100.74	97.25
Memo items:										
International bunkers	0.10	0.10	0.03	0.04	0.04	0.06	0.03	0.02	0.01	0.00
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	0.09	0.09	0.03	0.04	0.04	0.06	0.03	0.02	0.01	0.00
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO_2 emissions from biomass										
CO_2 captured										
Long-term storage of C in waste disposal sites										
Indirect N_2O										
Indirect CO_2 (3)										

Notes:

All footnotes for this table are given on sheet 3 of table 1(b).

Table 1(b)
Emission trends (CH_4)
(Sheet 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Energy	15.30	14.18	14.86	14.81	13.67	13.88	14.36	12.54	12.64	11.80	12.20
A. Fuel combustion (sectoral approach)	8.79	8.15	9.02	8.71	8.91	9.16	9.03	8.72	8.72	7.77	8.40
1. Energy industries	0.19	0.15	0.17	0.18	0.20	0.20	0.17	0.19	0.19	0.18	0.18
2. Manufacturing industries and construction	0.15	0.12	0.16	0.16	0.15	0.19	0.23	0.25	0.22	0.24	0.30
3. Transport	0.45	0.47	0.51	0.48	0.45	0.42	0.39	0.38	0.36	0.30	0.24
4. Other sectors	8.00	7.41	8.18	7.89	8.11	8.34	8.23	7.90	7.95	7.06	7.67
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive emissions from fuels	6.51	6.03	5.84	6.10	4.76	4.71	5.33	3.82	3.92	4.03	3.81
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	6.51	6.03	5.84	6.10	4.76	4.71	5.33	3.82	3.92	4.03	3.81
C. CO_2 transport and storage											
2. Industrial processes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A. Mineral industry											
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Non-energy products from fuels and solvent use	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
3. Agriculture	32.29	32.47	34.31	33.99	33.99	32.89	33.91	34.19	35.77	34.75	34.66
A. Enteric fermentation	29.24	29.33	30.69	30.26	30.24	29.21	30.11	30.28	31.64	30.66	30.56
B. Manure management	3.05	3.14	3.62	3.73	3.75	3.68	3.80	3.92	4.13	4.09	4.10
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming											
H. Urea application											
I. Other carbon-containing fertilizers											
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	20.82	20.21	18.73	19.71	18.79	18.47	17.44	19.01	17.17	16.99	17.61
A. Forest land	6.89	6.44	5.09	6.19	5.38	5.21	4.34	5.95	4.36	4.36	5.15
B. Cropland	6.23	6.15	6.08	6.01	5.94	5.86	5.79	5.72	5.66	5.60	5.54
C. Grassland	5.70	5.57	5.47	5.38	5.30	5.18	5.05	5.04	4.81	4.64	4.49
D. Wetlands	2.01	2.05	2.09	2.13	2.17	2.22	2.26	2.30	2.34	2.39	2.43
E. Settlements	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products											
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	24.67	25.68	26.32	25.64	23.07	22.78	23.23	23.10	23.37	23.65	23.72

A. Solid waste disposal	16.08	16.63	17.17	16.86	15.63	14.66	15.19	15.70	16.33	16.22	16.51
B. Biological treatment of solid waste	0.86	0.85	0.84	0.83	0.83	0.85	0.83	0.85	0.83	0.82	0.84
C. Incineration and open burning of waste	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
D. Waste water treatment and discharge	7.73	8.20	8.31	7.95	6.61	7.28	7.21	6.55	6.21	6.61	6.38
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CH_4 emissions without CH_4 from LULUCF	72.26	72.32	75.50	74.45	70.74	69.55	71.50	69.83	71.78	70.20	70.59
Total CH_4 emissions with CH_4 from LULUCF	93.08	92.54	94.23	94.16	89.53	88.02	88.94	88.84	88.95	87.19	88.20
Memo items:											
International bunkers	0.00	0.00	0.04	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.06
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	0.00	0.00	0.04	0.04	0.04	0.04	0.05	0.04	0.03	0.04	0.05
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO_2 emissions from biomass											
CO_2 captured											
Long-term storage of C in waste disposal sites											
Indirect N_2O											
Indirect CO_2 (3)											

Notes:

All footnotes for this table are given on sheet 3 of table 1(b).

Emission trends (CH_4)
(Sheet 3 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
									%
1. Energy	10.79	9.54	10.79	11.15	12.40	10.34	10.88	12.92	-34.97
A. Fuel combustion (sectoral approach)	7.13	7.02	7.60	7.11	6.99	6.23	6.22	6.82	-31.62
1. Energy industries	0.20	0.19	0.22	0.32	0.38	0.41	0.52	0.59	210.92
2. Manufacturing industries and construction	0.37	0.44	0.49	0.50	0.57	0.56	0.50	0.51	113.99
3. Transport	0.25	0.22	0.20	0.19	0.18	0.17	0.16	0.16	-78.52
4. Other sectors	6.31	6.18	6.70	6.10	5.86	5.08	5.03	5.55	-36.75
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
B. Fugitive emissions from fuels	3.66	2.52	3.18	4.04	5.41	4.11	4.66	6.11	-38.33
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	0.00
2. Oil and natural gas and other emissions from energy production	3.66	2.52	3.18	4.04	5.41	4.11	4.66	6.11	-38.33
C. CO_2 transport and storage									
2. Industrial processes	0.00	0.00	0.00	0.00	0.00	0.00	NO, NA	NO, NA	
A. Mineral industry									
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C. Metal industry	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	
D. Non-energy products from fuels and solvent use	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
E. Electronic industry									
F. Product uses as ODS substitutes									
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	0.00
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
3. Agriculture	34.42	34.81	35.59	36.95	38.33	38.37	38.46	38.76	-59.82
A. Enteric fermentation	30.52	30.90	31.91	33.28	34.46	34.33	34.41	34.69	-60.96
B. Manure management	3.90	3.91	3.68	3.67	3.86	4.05	4.05	4.06	-46.49
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Agricultural soils	NE	NE	NE	NE	NE	NE	NE	NE	0.00
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	0.00
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Liming									
H. Urea application									
I. Other carbon-containing fertilizers									
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
4. Land use, land-use change and forestry	17.78	18.14	18.58	19.13	19.90	20.29	20.78	21.33	6.85
A. Forest land	5.44	5.92	6.45	7.10	7.94	8.41	8.98	9.47	96.53
B. Cropland	5.48	5.42	5.36	5.30	5.24	5.20	5.15	5.17	-25.93
C. Grassland	4.33	4.18	4.04	3.90	3.78	3.65	3.52	3.44	-47.29
D. Wetlands	2.53	2.63	2.73	2.83	2.93	3.04	3.14	3.24	99.20
E. Settlements	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Harvested wood products									

H. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
5. Waste	23.94	22.97	22.69	22.26	21.91	20.41	21.81	20.51	-18.51
A. Solid waste disposal	16.70	16.77	16.88	16.41	16.42	15.30	16.42	16.14	42.51
B. Biological treatment of solid waste	0.83	0.84	0.78	0.78	0.90	1.03	1.30	1.14	18.77
C. Incineration and open burning of waste	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO, NA	NO, NA	0.00
D. Waste water treatment and discharge	6.41	5.37	5.02	5.06	4.58	4.08	4.09	3.23	-74.89
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Total CH_4 emissions without CH_4 from LULUCF	69.16	67.33	69.07	70.36	72.64	69.12	71.15	72.19	-48.98
Total CH_4 emissions with CH_4 from LULUCF	86.94	85.47	87.66	89.49	92.53	89.42	91.93	93.51	-42.08
Memo items:									
International bunkers	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	-43.47
Aviation	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	236.47
Navigation	0.05	0.04	0.05	0.05	0.05	0.05	0.06	0.05	-48.05
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	0.00
CO_2 emissions from biomass									
CO_2 captured									
Long-term storage of C in waste disposal sites									
Indirect N_2O									
Indirect CO_2 (3)									

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

Table 1(c)
Emission trends (N_2O)
(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
1. Energy	1.02	1.02	1.19	0.90	0.79	0.49	0.44	0.44	0.44	0.41
A. Fuel combustion (sectoral approach)	1.02	1.02	1.19	0.90	0.79	0.49	0.44	0.44	0.44	0.41
1. Energy industries	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
2. Manufacturing industries and construction	0.18	0.18	0.17	0.13	0.13	0.07	0.06	0.06	0.07	0.07
3. Transport	0.27	0.27	0.26	0.22	0.16	0.14	0.15	0.14	0.15	0.14
4. Other sectors	0.53	0.53	0.72	0.52	0.47	0.24	0.20	0.21	0.19	0.17
5. Other	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	0.00	0.00	0.00
B. Fugitive emissions from fuels	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
1. Solid fuels	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
2. Oil and natural gas and other emissions from energy production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. CO_2 transport and storage										
2. Industrial processes	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
A. Mineral industry										
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
E. Electronic industry										
F. Product uses as ODS substitutes										
G. Other product manufacture and use	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
3. Agriculture	9.53	9.53	8.97	7.39	6.05	5.56	5.10	5.11	5.11	4.97
A. Enteric fermentation										
B. Manure management	0.99	0.99	0.95	0.78	0.53	0.48	0.47	0.45	0.43	0.40
C. Rice cultivation										
D. Agricultural soils	8.54	8.54	8.02	6.61	5.52	5.09	4.62	4.66	4.68	4.57
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming										
H. Urea application										
I. Other carbon containing fertlizers										
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	1.94	1.94	1.94	1.97	1.94	1.94	1.95	1.95	1.96	1.96
A. Forest land	1.91	1.91	1.91	1.94	1.91	1.91	1.91	1.92	1.92	1.92
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Wetlands	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
E. Settlements	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products										
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	0.23	0.23	0.23	0.23	0.22	0.21	0.20	0.18	0.18	0.17

A. Solid waste disposal										
B. Biological treatment of solid waste	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste water treatment and discharge	0.18	0.18	0.18	0.17	0.17	0.16	0.15	0.13	0.12	0.12
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total direct N_2O emissions without N_2O from LULUCF	10.80	10.80	10.40	8.53	7.07	6.27	5.75	5.74	5.74	5.56
Total direct N_2O emissions with N_2O from LULUCF	12.73	12.73	12.34	10.50	9.02	8.21	7.69	7.69	7.69	7.52
Memo items:										
International bunkers	0.19	0.19	0.04	0.04	0.06	0.11	0.05	0.04	0.03	0.02
Aviation	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Navigation	0.18	0.18	0.03	0.03	0.06	0.11	0.04	0.03	0.03	0.02
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO_2 emissions from biomass										
CO_2 captured										
Long-term storage of C in waste disposal sites										
Indirect N_2O	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA
Indirect CO_2 (3)										

Notes:

All footnotes for this table are given on sheet 3 of table 1(c).

Table 1(c) LVA_BR4_v0.1

Emission trends (N_2O)

(Sheet 2 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Energy	0.40	0.39	0.42	0.43	0.46	0.49	0.48	0.51	0.54	0.49	0.51
A. Fuel combustion (sectoral approach)	0.40	0.39	0.42	0.43	0.46	0.49	0.48	0.51	0.54	0.49	0.51
1. Energy industries	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
2. Manufacturing industries and construction	0.06	0.06	0.06	0.06	0.05	0.06	0.07	0.08	0.08	0.08	0.08
3. Transport	0.13	0.14	0.15	0.15	0.17	0.17	0.18	0.17	0.18	0.18	0.15
4. Other sectors	0.18	0.18	0.19	0.19	0.21	0.22	0.22	0.24	0.25	0.22	0.25
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive emissions from fuels	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
1. Solid fuels	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
2. Oil and natural gas and other emissions from energy production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. CO_2 transport and storage											
2. Industrial processes	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
A. Mineral industry											
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
E. Electronic industry											
F. Product uses as ODS substitutes											
G. Other product manufacture and use	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
3. Agriculture	4.75	4.80	5.05	4.93	5.06	5.00	5.15	5.12	5.29	5.28	5.32
A. Enteric fermentation											
B. Manure management	0.36	0.36	0.38	0.38	0.38	0.36	0.36	0.36	0.37	0.35	0.34
C. Rice cultivation											
D. Agricultural soils	4.39	4.44	4.66	4.55	4.69	4.64	4.79	4.76	4.92	4.93	4.98
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Liming											
H. Urea application											
I. Other carbon containing fertlizers											
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	1.98	1.98	1.98	2.00	2.00	2.01	2.01	2.04	2.02	2.03	2.03
A. Forest land	1.93	1.93	1.92	1.93	1.92	1.92	1.91	1.92	1.90	1.90	1.91
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
D. Wetlands	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
E. Settlements	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.10	0.11
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products											
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5. Waste	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.18	0.18
A. Solid waste disposal											
B. Biological treatment of solid waste	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Waste water treatment and discharge	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.13	0.13
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total direct N_2O emissions without N_2O from LULUCF	5.33	5.37	5.64	5.53	5.69	5.66	5.80	5.81	6.01	5.96	6.01
Total direct N_2O emissions with N_2O from LULUCF	7.31	7.35	7.62	7.54	7.70	7.67	7.81	7.85	8.03	7.98	8.05
Memo items:											
International bunkers	0.02	0.01	0.14	0.12	0.11	0.11	0.13	0.10	0.09	0.08	0.11
Aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Navigation	0.01	0.01	0.14	0.12	0.10	0.11	0.13	0.09	0.09	0.07	0.10
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO_2 emissions from biomass											
CO_2 captured											
Long-term storage of C in waste disposal sites											
Indirect N_2O	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA
Indirect CO_2 (3)											

Notes:

All footnotes for this table are given on sheet 3 of table 1(c).

Table 1(c)
Emission trends (N_2O)
(Sheet 3 of 3)

LVA_BR4_v0.1

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
									%
1. Energy	0.52	0.53	0.57	0.58	0.60	0.60	0.58	0.62	-38.88
A. Fuel combustion (sectoral approach)	0.52	0.53	0.57	0.58	0.60	0.60	0.58	0.62	-38.88
1. Energy industries	0.03	0.02	0.03	0.04	0.05	0.05	0.07	0.08	106.21
2. Manufacturing industries and construction	0.09	0.11	0.12	0.12	0.12	0.12	0.11	0.11	-37.97
3. Transport	0.15	0.16	0.17	0.17	0.17	0.17	0.16	0.16	-40.03
4. Other sectors	0.25	0.24	0.25	0.25	0.26	0.26	0.25	0.27	-49.04
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
B. Fugitive emissions from fuels	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
1. Solid fuels	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
2. Oil and natural gas and other emissions from energy production	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C. CO_2 transport and storage									
2. Industrial processes	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	13.58
A. Mineral industry									
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Non-energy products from fuels and solvent use	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
E. Electronic industry									
F. Product uses as ODS substitutes									
G. Other product manufacture and use	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	13.58
H. Other	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
3. Agriculture	5.42	5.38	5.62	5.68	5.78	5.99	5.95	5.97	-37.35
A. Enteric fermentation									
B. Manure management	0.33	0.32	0.31	0.30	0.31	0.30	0.30	0.29	-70.65
C. Rice cultivation									
D. Agricultural soils	5.09	5.06	5.32	5.37	5.48	5.68	5.66	5.68	-33.49
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	0.00
F. Field burning of agricultural residues	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Liming									
H. Urea application									
I. Other carbon containing fertlizers									
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
4. Land use, land-use change and forestry	2.04	2.04	2.04	2.05	2.06	2.06	2.07	2.07	6.91
A. Forest land	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	-0.65
B. Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
C. Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	123.20
D. Wetlands	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-29.29
E. Settlements	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.15	6,674.66

F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Harvested wood products									
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
5. Waste	0.17	0.17	0.16	0.16	0.17	0.17	0.19	0.18	-25.28
A. Solid waste disposal									
B. Biological treatment of solid waste	0.05	0.05	0.05	0.05	0.06	0.06	0.08	0.07	18.77
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-46.61
D. Waste water treatment and discharge	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	-39.52
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Total direct N_2O emissions without N_2O from LULUCF	6.12	6.10	6.37	6.43	6.56	6.78	6.73	6.78	-37.18
Total direct N_2O emissions with N_2O from LULUCF	8.15	8.14	8.41	8.48	8.62	8.84	8.80	8.85	-30.47
Memo items:									
International bunkers	0.12	0.12	0.14	0.12	0.11	0.18	0.24	0.20	7.21
Aviation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	158.07
Navigation	0.10	0.11	0.12	0.11	0.10	0.17	0.22	0.18	2.06
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	0.00
CO_2 emissions from biomass									
CO_2 captured									
Long-term storage of C in waste disposal sites									
Indirect N_2O	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	NO, IE, NA	0.00
Indirect CO_2 (3)									

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

Table 1(d)
Emission trends (HFCs, PFCs and SF_6)
(Sheet 1 of 3)

LVA_BR4_v0.1

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	*Base year[a]*	1990	1991	1992	1993	1994	1995	1996	1997	1998
	kt									
Emissions of HFCs and PFCs - (kt CO_2 equivalent)	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	2.50	2.76	3.35	7.60
Emissions of HFCs - (kt CO_2 equivalent)	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	NO, NE, NA	2.50	2.76	3.35	7.60
HFC-23	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	0.00	0.00	0.00	0.00
HFC-32	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO
HFC-41	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-43-10mee	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-125	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO
HFC-134	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-134a	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	0.00	0.00	0.00	0.00
HFC-143	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-143a	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO
HFC-152	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-152a	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE
HFC-161	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-227ea	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE
HFC-236cb	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-236ea	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-236fa	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-245ca	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-245fa	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE
HFC-365mfc	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE
Unspecified mix of HFCs(4) - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Emissions of PFCs - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
CF_4	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_2F_6	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_3F_8	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_4F_{10}	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
c-C_4F_8	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_5F_{12}	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_6F_{14}	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
$C_{10}F_{18}$	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
c-C_3F_6	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA

Unspecified mix of PFCs(4) - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Emissions of SF_6 - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.17	0.18	0.37	0.52
SF_6	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00	0.00	0.00	0.00
Emissions of NF3 - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
NF_3	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA

Notes:
All footnotes for this table are given on sheet 3 of table 1(d).

Table 1(d)
Emission trends (HFCs, PFCs and SF_6)
(Sheet 2 of 3)

LVA_BR4_v0.1

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Emissions of HFCs and PFCs - (kt CO_2 equivalent)	10.57	14.08	17.89	21.66	25.50	40.70	55.00	87.99	114.05	141.65	155.27
Emissions of HFCs - (kt CO_2 equivalent)	10.57	14.08	17.89	21.66	25.50	40.70	55.00	87.99	114.05	141.65	155.27
HFC-23	0.00	0.00	0.00	0.00	0.00	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	0.00	0.00
HFC-32	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-43-10mee	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-125	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	0.00	0.00	0.01	0.01	0.01	0.01
HFC-134	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-134a	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.05
HFC-143	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-143a	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	0.00	0.00	0.00	0.01	0.01	0.01
HFC-152	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-152a	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	0.00	0.00	0.00	0.00
HFC-161	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-227ea	NO, NA, NE	NO, NA, NE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236cb	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-236ea	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-236fa	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-245ca	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-245fa	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	NE, NA, NO	0.00	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
HFC-365mfc	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	NO, NA, NE	0.00	0.00
Unspecified mix of HFCs(4) - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Emissions of PFCs - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
CF_4	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_2F_6	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_3F_8	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_4F_{10}	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
c-C_4F_8	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_5F_{12}	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
C_6F_{14}	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
$C_{10}F_{18}$	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
c-C_3F_6	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Unspecified mix of PFCs(4) - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Emissions of SF_6 - (kt CO_2 equivalent)	0.71	0.88	1.39	2.62	2.76	3.25	3.78	4.07	4.55	5.23	7.33

SF_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions of NF_3 - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
NF_3	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA

Notes:
All footnotes for this table are given on sheet 3 of table 1(d).

Table 1(d) LVA_BR4_v0.1

Emission trends (HFCs, PFCs and SF_6)

(Sheet 3 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
									%
Emissions of HFCs and PFCs - (kt CO2 equivalent)	166.06	171.24	175.95	191.21	206.11	219.56	240.84	234.92	100.00
Emissions of HFCs - (kt CO2 equivalent)	166.06	171.24	175.95	191.21	206.11	219.56	240.84	234.92	100.00
HFC-23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-41	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-43-10mee	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-125	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	100.00
HFC-134	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-134a	0.05	0.05	0.05	0.06	0.07	0.07	0.08	0.08	100.00
HFC-143	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-143a	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	100.00
HFC-152	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-152a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-161	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-236cb	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-236ea	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-236fa	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-245ca	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
HFC-245fa	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	0.00	0.00	0.00	100.00
HFC-365mfc	0.00	0.00	0.00	0.00	0.00	0.00	NO, NA	NO, NA	0.00
Unspecified mix of HFCs(4) - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
Emissions of PFCs - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00
CF_4	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
C_2F_6	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
C_3F_8	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
C_4F_{10}	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
c-C_4F_8	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
C_5F_{12}	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
C_6F_{14}	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
$C_{10}F_{18}$	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
c-C_3F_6	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
Unspecified mix of PFCs(4) - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NA, NO	NA, NO	NO, NA	NO, NA	0.00
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00
Emissions of SF_6 - (kt CO_2 equivalent)	7.35	7.47	7.78	8.50	8.58	10.12	9.89	10.32	100.00
SF_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Emissions of NF_3 - (kt CO_2 equivalent)	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00
NF_3	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	0.00

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

[a] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[c]Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

[d]In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.)

CTF Table 2: Description of quantified economy-wide emission reduction target

Table 2(a) LVA_BR4_v0.1

Description of quantified economy-wide emission reduction target: base year[a]

Party	*Latvia*	
Base year /base period	1990	
Emission reduction target	% of base year/base period	% of 1990 [b]
	20.00%	20.00%
Period for reaching target	BY-2020	

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.
[b] Optional.

Table 2(b) LVA_BR4_v0.1

Description of quantified economy-wide emission reduction target: gases and sectors covered[a]

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		NA
Other Gases (specify)		
Sectors covered[b]	Energy	Yes
	Transport[f]	Yes
	Industrial processes[g]	Yes
	Agriculture	Yes
	LULUCF	No
	Waste	Yes
	Other Sectors (specify)	

Abbreviations: LULUCF = land use, land-use change and forestry.
[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.
[b] More than one selection will be allowed. If Parties use sectors other than those indicated above, the explanation of how these sectors relate to the sectors defined by the IPCC should be provided.
[f] Transport is reported as a subsector of the energy sector.
[g] Industrial processes refer to the industrial processes and solvent and other product use sectors.

Table 2(c) LVA_BR4_v0.1

Description of quantified economy-wide emission reduction target: global warming potential values (GWP)[a]

Gases	*GWP values [b]*
CO_2	4th AR
CH_4	4th AR
N_2O	4th AR
HFCs	4th AR
PFCs	4th AR
SF_6	4th AR
NF_3	
Other Gases (specify)	

Abbreviations: GWP = global warming potential

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Please specify the reference for the GWP: Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) or the Fourth Assessment Report of the IPCC.

Table 2(d) LVA_BR4_v0.1

Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector[a]

Role of LULUCF	LULUCF in base year level and target	Excluded
	Contribution of LULUCF is calculated using	

Abbreviation: LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

Table 2(e)I LVA_BR4_v0.1

Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention[a]

Market-based mechanisms under the Convention	*Possible scale of contributions (estimated kt CO_2 eq)*
CERs	NA
ERUs	NA
AAUs[i]	NA
Carry-over units[j]	NA
Other mechanism units under the Convention (specify)[d]	

Abbreviations: AAU = assigned amount unit, CER = certified emission reduction, ERU = emission reduction unit.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[d] As indicated in paragraph 5(e) of the guidelines contained in annex I of decision 2/CP.17 .

[i] AAUs issued to or purchased by a Party.

[j] Units carried over from the first to the second commitment periods of the Kyoto Protocol, as described in decision 13/CMP.1 and consistent with decision 1/CMP.8.

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

No information provided in Table 2(e)II.

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

No information provided in Table 2(f).

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

LVA_BR4_v0.1

Table 3

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

Name of mitigation action[a]	*Sector(s) affected[b]*	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument[c]*	*Status of implementation[d]*	*Brief description[e]*	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*		
									2020	*2025[f]*	*2030[f]*
Energy Efficiency Requirements for District Heating Systems*	Energy	CO_2	Reduction of losses (Energy supply); Efficiency improvement in the energy and transformation sector (Energy supply)	Regulatory	Implemented	It is defined (I) maximum heat losses in District Heating pipeline network and (II) the minimum energy efficiency requirements for the following District Heating technologies: 1.heat production boilers; 2. combined heat-power production units; 3. solar heat collectors; 4. heat pumps.	2018	Ministry of Economics (Government)	NE	NE	NE
Voluntary Agreements on Energy Efficiency*	Energy	CO_2	Energy consumption (comprising consumption of fuels and electricity by end users); Efficiency improvement in the energy and transformation sector (Energy supply); Reduction of losses (Energy supply)	Voluntary Agreement	Implemented	The actual procedure to co-operate with the business sector and other actors are established by the Cabinet of Ministers Regulation No.669 (2016) "Procedure for Entering into and Supervision of Energy Efficiency Improvement Agreements". The agreement shall have the target – at least 10% of energy efficiency improvement and shall be entered into for a time period of not shorter than five years. The achievement of the energy savings target shall be justified by the energy efficiency action plan and reporting.	2016	Ministry of Economics (Government)	NE	NE	NE
Investment Support to Promote RES, by-products and waste use for the Bioeconomics development:	Energy, Agriculture	CO_2, CH_4	Increase in renewable energy (Energy supply); Improved animal waste management systems (Agriculture)	Economic	Adopted	The co-financing is provided by national Rural Development Programme under the Priority 5C to promote the production of renewable energy. The support is provided within the measure "Investment support in rural farms". The production of energy from manure is one of supported technologies, thus	2019	Ministry of Agriculture (Government)	12.00	21.00	21.00

2014-2020 EU Funds programming period*						the measure promotes better management of manure resulting in decrease of CH_4 emissions in ESD (non-ETS) sector. Renewable electricity production in local installations will decrease the demand of electricity provided by ETS sector.					
Investment Support Programme to increase energy efficiency in multi-apartment buildings: 2014-2020 EU Funds programming period*	Energy	CO_2	Efficiency improvement of buildings (Energy consumption)	Economic	Implemented	Increasing of energy efficiency in multi-apartment buildings is co-financed by ERDF within the framework of the national Operational Programme "Growth and Employment", Specific Objective 4.2.1.1 "To increase energy efficiency in residential buildings". Activities supported relate to renovation of apartment buildings for the increase of energy efficiency, reconstruction of heat supply and hot water supply systems of buildings, installation of recuperation, energy control and management equipment, including smart meters. The financial assistance is provided in the following forms of subsidy (grant), repayable loan with low interest rate, guarantee for the loan. Specific condition of Latvia is the high relative share of buildings supplied by district heating systems. As large number of Latvia district heating utilities participate in EU ETS, the given PAM has impact in both ETS and ESD (non-ETS) sectors.	2016	Ministry of Economics (Government)	26.00	40.00	40.00
Energy Performance of Buildings*	Energy	CO_2	Efficiency improvement of buildings (Energy consumption)	Regulatory	Implemented	The re-casted Law on the Energy Performance of Buildings (adopted Dec 2012, transposition of the Directive 2010/31/EC on the energy performance of buildings) re-casted the general legal framework of setting the mandatory minimum energy performance requirements for buildings, the general principles of mandatory energy efficiency certification for buildings, verification of buildings heating and ventilation systems. The energy efficiency classification system (six energy efficiency classes) for buildings are	2016	Ministry of Economics (Government)	NE	NE	NE

						introduced by Cabinet of Ministers Regulation, both the transition to new nearly zero energy buildings (both private and public sector), the minimum permissible levels of energy performance values for heating for the buildings to be reconstructed or renovated, and the energy performance value for heating in case of exceeding it the building needs energy performance improvement measures are established. National Latvian Construction Standard "Thermotechnics of Building Envelopes" transposes the requirements of the Directive 2010/31/EU. The given PAM in Latvia case has impact on district heat consumption especially in residential multi-flat buildings - a large number of Latvia district heating utilities participate in ETS sector. Thus given PAM has impact on both ETS and ESD (non-ETS) sectors.					
Informing Energy Consumers of Residential Sector (Multi-apartment buildings)*	Energy	CO_2	Efficiency improvement of buildings (Energy consumption)	Information	Implemented	The measure motivates to renovate buildings in the frame of the ERDF supported activity of Increasing energy efficiency in multi-apartment buildings. The measure informs and consults societies of the flats' owners regarding conditions and benefits of energy efficiency increase, raises overall understanding on energy efficiency and thus promotes to reduce heat energy consumption. Wide scope of information methods are applied by the informative programme "Let's live warmer!" to reach the target group. The financial support for preparation of technical documentation related to buildings' energy efficient renovation is stated as the eligible cost for multi-apartment building renovation co-financed in 2014-2020 EU Funds programming period. The given PAM has impact on district heat consumption especially in residential buildings (multi-flat buildings) - a large	2016	Ministry of Economics (Government)	NE	NE	NE

						number of Latvia district heating utilities participate in ETS sector. Thus given PAM has impact on both ETS and ESD (non-ETS) sectors.					
Energy Labeling on Household Appliances*	Energy	CO_2	Efficiency improvement of appliances (Energy consumption)	Regulatory	Implemented	The transposition of the requirements of the Ecodesign Directive 2009/125/EC and of the revised Directive on Labelling and standard product information of Energy Related Products (2010/30/EU) had been done by the Cabinet of Ministers Regulations in 2011. The requirements stated by the respective EC Delegated Regulations are implemented directly.	2011	Ministry of Economics (Government)	NE	NE	NE
Biofuel Mix Obligation Requirement*	Transport	CO_2	Low carbon fuels/electric cars (Transport); increase in renewable energy (Other transport)	Regulatory	Implemented	To ensure growth of the share of RES in the transport sector, in 01.10.2009 Latvia had introduced the Biofuel Mix Obligation Requirement. Bioethanol mix, 4.5-5% (volume) of total volume, is mandatory for the gasoline of "95" trademark. Biodiesel mix, 4.5-7% (volume) of total volume (if the biodiesel produced from rapeseed oil is mixed) or at least 4.5% (volume) of total volume (if the paraffinic diesel produced from the biomass is mixed), is mandatory for the diesel fuel (exemption is made for diesels utilised in winter climate conditions).	2010	Ministry of Economics (Government)	81.00	86.00	88.00
Excise Tax – Transport sector*	Transport	CO_2	Efficiency improvements of vehicles (Transport); Low carbon fuels/electric cars (Transport); Demand management/reduction (Transport)	Fiscal	Implemented	The procedure is established by the Law "On Excise Duties": duty for gasoline, diesel fuel (gas oil) and LPG (Articles 5,14 & 18) and duty for natural gas (Articles 6.1 & 15.1).	1993	Ministry of Finance (Government)	NE	NE	NE
Annual taxation of vehicles*	Transport	CO_2	Efficiency improvements of vehicles (Transport); Modal shift to public transport or non-motorized	Fiscal	Implemented	The cars' annual operation tax system based on the specific CO_2 emissions of the car (plus fixed supplement for those engines capacity of which exceeds 3500 cm3) is introduced for the new cars (from 01.01.2017) and for	2007	Ministry of Transport (Government)	41.00	41.00	47.00

			transport (Transport)			the cars firstly registered in the period 01.01.2009-31.12.2016 (from 01.01.2019). For the cars with the specific CO_2 emissions up to 50 grams per km zero tax rate is applied. For the older cars the duty continues to base on engine capacity, maximal power of engine and the gross weight of the car. For goods vehicles and busses the duty is based on the gross weight of the vehicle as well as specific technical features.					
New Passenger Cars Labelling on Fuel Economy Rating*	Transport	CO_2	Efficiency improvements of vehicles (Transport); Low carbon fuels/electric cars (Transport)	Regulatory, Information	Implemented	The labelling of cars regarding fuel consumption (litres per 100 km or km per litre) and CO_2 emissions (grams per km).	2003	Ministry of Economics (Government)	56.00	115.00	135.00
Taxation of Electricity*	Energy	CO_2	Energy consumption (comprising consumption of electricity by end users); Efficiency improvement in the energy and transformation sector (Energy supply)	Fiscal	Implemented	The procedure is prescribed by the Electricity Tax Law. The actual rate is 1.01 EUR/MWh. Electricity supplied to an end user, as well as electricity, which is supplied for own consumption, shall be taxable, except for the cases specified in the Law. Tax shall apply to entities who are engaged in the generation, distribution, supply, selling of electricity as well as purchasing electricity in electricity spot exchange. From 01.01.2017 the following exemptions are in force: (i) carriage of goods and public carriage of passengers, including on rail transport and public transport in towns, (ii) household users, (iii street lighting services. The exemption is made also for autonomous producers if they correspond to certain criteria.	2007	Ministry of Finance (Government)	NE	NE	NE
Taxation of CO_2 emissions*	Energy	CO_2	Efficiency improvement in industrial and services/ tertiary end-use sectors; Efficiency improvement in the energy and	Fiscal	Implemented	The procedure is prescribed by the Natural Resources Tax Law. The implementation of the given PAM started in 2005 as the national policy to get environmental benefits and to start to internalise the external costs related to GHG emissions, afterwards this policy was linked with EU GHG policies.	2005	Ministry of Finance (Government)	NE	NE	NE

			transformation sector (Energy supply); Increase in renewable energy (Energy supply)			The subject of CO_2 taxation is CO_2 emitting activities (installations) requiring a GHG emission permit - if the amount of the activity (installation) is below the threshold limit defined for inclusion in EU ETS. The tax shall not be paid (i) for the CO_2 emissions which emerges from the installations participating in the EU ETS, and (ii) while using renewable energy sources and local peat. The tax rate per 1 ton of CO_2 emission is gradually raised up to 4.50 EUR (from 01.01.2017).					
Taxation on Noxious Air Polluting Emissions*	Energy	CO_2	Efficiency improvement in the energy and transformation sector (Energy supply); Efficiency improvement in the industrial and services end-use sectors	Fiscal	Implemented	The procedure is prescribed by the Natural Resources Tax Law. The emissions of PM10, CO, SO_2, NOx, NH_3, H_2S and other non-organic compounds, C_nH_m, VOC, metals (Cd, Ni, Sn, Hg, Pb, Zn, Cr, As, Se, Cu) and their compounds, V_2O_5 are taxable. Improvement of combustion processes as the technical measure to control noxious emissions results in reducing fuel consumption as well thus creating synergy with GHG emissions emerging in both ETS and ESD (non-ETS) sectors. The tax shall be paid by entities which should have pollution permits of A,B,C categories. The given PAM relates to the enterpises both of ETS and ESD (non-ETS) sectors, motivating the use of cleaner fuel, thus have impact in both sectors. The implementation of the given PAM started in 1991 as the national policy to get environmental benefits and to start to internalise external costs related to environmental pollution, afterwards this policy was linked with implementation of EU environmental legislation.	1991	Ministry of Finance (Government)	NE	NE	NE
Systematic inspection of the technical conditions of motor vehicles*	Transport	CO_2	Efficiency improvements of vehicles (Transport)	Regulatory	Implemented	Mandatory annual technical inspections of motor vehicles ensure that only those vehicles that comply with technical and environmental requirements are being allowed to take part in road transport. PAM had started	1996	Ministry of Transport (Government)	NE	NE	NE

						as the national policy, afterwards transposed EU Directive requirements.					
Development of the infrastructure of environmentally friendly public transport (PT): 2014-2020 EU Funds Programming Period*	Transport	CO_2	Modal shift to public transport transport (Transport)	Economic	Implemented	Development of the infrastructure of PT is supported by EU Cohesion Fund within the framework of the national Operational Programme "Growth and Employment" (the Specific Objective 4.5.1). The use of PT is promoted by increase of number of environmentally friendly vehicles of PT (trams and buses) and length of tram lines. Thus, more effective urban transport infrastructure will be developed resulting that the flow of passengers will direct from private transport to PT and emissions will be reduced. Investments are made in accordance with cities development plans.	2016	Ministry of Transport (Government)	2.00	3.00	5.00
Performance of Heat Generators for Space Heating and the Production of Hot Water*	Energy	CO_2	Efficiency improvement in services/ tertiary sector (Energy consumption)	Regulatory	Implemented	In 26 September 2013 the Commission Regulation (EU) No 813/2013 of 2 August 2013, implementing the Directive 2009/125/EC, had come into force. Latvia had used the transition period. Namely, up to 26 September 2015 the Latvia Governmental Regulation No 416 regarding Hot-Water Boilers (adopted 22.04.2004) were in force.	2004	Ministry of Economics (Government)	NE	NE	NE
Investment Support Programme for District Heating (DH) Systems: 2014-2020 EU Funds programming period*	Energy	CO_2	Increase in renewable energy (Energy supply); Reduction of losses (Energy supply); Efficiency improvement in the energy and transformation sector (Energy supply)	Economic	Implemented	The increasing efficiency (production technologies and pipeline network) and RES share in DH supply systems is supported within the framework of the National Operational Programme "Growth and Employment", Specific Objective 4.3.1. "To promote energy efficiency and use of local RES in the district heating supply", co-financed by EU Cohesion Fund. Activities supported:(i) replacement or reconstruction for increase of energy efficiency of heat production sources using RES (heat boilers and heat accumulation units), (ii) reconstruction and construction of DH transmission	2017	Ministry of Economics (Government)	71.50	76.00	76.00

						and distribution systems aimed at reducing heat losses.					
Investment Support in Manufacturing Industry sector to promote energy efficiency and RES use: 2014-2020 EU Funds programming period*	Energy	CO_2	Efficiency improvement in industrial end-use sectors (Energy consumption); Increase in renewable energy (Energy supply); Efficiency improvements of buildings (Energy consumption)	Economic	Implemented	Development of new, innovative energy-saving technology, measures increasing energy efficiency and share of RES in manufacturing industry is supported within the framework of the national Operational Programme "Growth and Employment" (the Specific Objective 4.1.1); the co-financing is provided by EU Cohesion Fund. Activities supported relate to improvement of energy efficiency of building's outer constructions and buiding's engineering system, improvement of energy efficiency of production equipment and technologies, installation of efficient lightning in inner premises, use of highly efficient RES (production of heat and electricity for own consumption).	2016	Ministry of Economics (Government)	8.00	21.00	21.00
Investment Support to Improve Energy Efficiency in Food Processing Enterprises: 2014-2020 EU Funds programming period*	Energy	CO_2	Efficiency improvement in industrial end-use sectors (Energy consumption); Efficiency improvements of buildings (Energy consumption)	Economic	Implemented	The co-financing is provided within the framework of the Measure 04.2 "Investments" of the national Rural Development Programme 2014-2020, supported by European Agriculture Fund for Rural Development. The support might be used for implementation of both energy efficient building (both new buildings and reconstruction) and new energy efficient equipment (both heating & ventilation equipment and equipment for production processes). The support might be used also for implementation of RES technologies in the enterprise.	2015	Ministry of Agriculture (Government)	NE	NE	NE
Investment Support Programme to Increase Energy Efficiency in Public Sector (State Central Government and Municipal) Buildings: 2014-	Energy	CO_2	Efficiency improvements of buildings (Energy consumption)	Economic	Implemented	Increasing of energy efficiency in state (central government) buildings is supported within the framework of the national Operational Programme "Growth and Employment", the Specific Objective 4.2.1.2 "To increase energy efficiency in state buildings". In its turn, the Specific Objective 4.2.2 "To facilitate increase of energy efficiency in municipal buildings, according to the	2016	Ministry of Economics (Government)	14.00	21.00	21.00

2020 EU Funds programming period*						integrated development programme of the municipality" is focused to municipal buildings. Activities are financed by European Regional Development Fund (ERDF) and national public budget. Activities relate to renovation of buildings for the increase of energy efficiency, reconstruction, renovation or establishment of engineering systems of buildings, installation of RES utilizing heat energy production equipment, installation of energy control and management equipment. As large number of Latvia district heating utilities, providing heat supply to buildings, participate in EU ETS, the given PAM has impact in both ETS and ESD (non-ETS) sectors.					
Investment Support Programmes on Energy Efficiency Measures to reduce GHG emissions: national Emissions Allowances Auctioning Instrument (EAAI)*	Energy	CO_2	Efficiency improvements of buildings (Energy consumption); Demand management/reduction (Energy consumption)	Economic	Implemented	The revenues due to the auctioning of Latvia's allocated EU ETS GHG emission allowances are used for co-financing the energy efficiency measures which have high demonstration value. Currently there are under implementation EAAI programmes focused to low/nearly zero energy public building comprising smart technologies as well as use of smart technologies for energy efficiency (e.g., efficient lightning) in urban environment.	2016	Ministry of Environment Protection and Regional Development (Government) (Government)	1.70	1.70	1.70
Electrical Vehicles Charging Infrastructure Development: 2014-2020 EU Funds programming period	Energy, Transport	CO_2	Low carbon fuels/electric cars (Transport)	Economic	Implemented	Development of electric vehicles (EV) charging infrastructure is supported by ERDF within the framework of the national Operational Programme "Growth and Employment", the Specific Objective 4.4.1. As a result single national level EV fast charging infrastructure coverage is ensured which promotes the development of EV market and increase of EVs in road transport.	2016	Ministry of Transport (Government)	10.00	35.00	115.00

Implementation of the EU Emissions Trading Scheme*	Energy	CO_2	Increase in renewable energy (Energy supply); Reduction of losses (Energy supply); Efficiency improvement in the energy and transformation sector (Energy supply)	Regulatory	Implemented	Limitation of amount of emission allowances allocated for EU ETS operators	2005	Ministry of Environment Protection and Regional Development (Government)	NE	NE	NE
Support for evolving of precision agriculture technologies in crop growing farms to reduce nitrogen use*	Agriculture	N_2O, CH_4	Other activities improving cropland management (Agriculture)	Voluntary Agreement	Implemented	Measure is associated with promoting of nitrogen fertilizer use reduction and consequently with reduction of nitrogen amount in the run-off. This will reduce N_2O emissions from use of synthetic fertilizers and indirect N_2O emissions from soils. Voluntary/negotiated agreements, because financial support for farmers is available, if a farmer develop precision agriculture technologies in the farm with the aim to reduce GHG emissions.	2014	Ministry of Agriculture (Government)	NE	NE	NE
Support for evolving of precision livestock feeding approach in cattle breeding farms to develop feeding plans and promote high quality feed use to increase the digestibility*	Agriculture	N_2O, CH_4	Improved livestock management (Agriculture)	Voluntary Agreement	Implemented	The main aim of measure is to promote high quality feed use for animals to increase the digestibility and reduce CH4 emissions. Voluntary/negotiated agreements, because financial support for farmers is available, if a farmer develop precision livestock feeding technologies in the farm with the aim to reduce GHG emissions.	2015	Ministry of Agriculture (Government)	NE	NE	NE
Introduction of leguminous plants on arable land*	Agriculture	N_2O	Other activities improving cropland management (Agriculture)	Voluntary Agreement	Implemented	Support to use of legumes as green manure and fodder in crop rotation. Financial support is defined in Regulations of the Cabinet of Ministers No. 126 (2015), that establishing procedures for receiving payments for climate and environmentally friendly farming practices, including legumes in	2015	Ministry of Agriculture (Government)	NE	NE	NE

						crop rotation. Measure is associated with promoting of nitrogen fertilizer use reduction. This will reduce N_2O emissions from use of synthetic and organic fertilizers.					
Management of nitrate vulnerable territories*	Agriculture	N_2O	Reduction of fertilizer/manure use on cropland (Agriculture)	Regulatory	Implemented	Restriction for nitrogen usage, reduction of nitrogen leaching. Water protection against pollution caused by nitrates from agricultural sources. Rules for management of vulnerable zones.	2014	Ministry of Agriculture (Government)	NE	NE	NE
Requirements for the protection of soil and water from agricultural pollution caused by nitrates*	Agriculture	N_2O	Reduction of fertilizer/manure use on cropland (Agriculture)	Regulatory	Implemented	Restriction for nitrogen usage, reduction of nitrogen leaching. Reduction of non-direct N_2O emissions	2014	Ministry of Agriculture (Government)	NE	NE	NE
Crop fertilization plans in vulnerable zones*	Agriculture	N_2O	Reduction of fertilizer/manure use on cropland (Agriculture); Other activities improving cropland management (Agriculture)	Regulatory	Implemented	According to Republic of Latvia Cabinet Regulation No. 834 (2014) "Regarding to Protection of Water and Soil from Pollution with Nitrates Caused by Agricultural Activity" in highly vulnerable zones farmers who managing the agricultural land with an area of 20 hectares and more, and grows vegetables, potatoes, fruit trees or fruit bushes in an area of three hectares and more, are required to document the field history for each field and shall keep field history documentation for at least three years and, if using fertilisers; shall prepare a crop fertilisation plan for each field not later than until the sowing or planting of a crop, for perennial sowings and plants - until the start of vegetation.	2012	Ministry of Agriculture (Government)	NE	NE	NE
Requirements for manure storage and spreading*	Agriculture	N_2O, CH_4	Improved animal waste management systems (Agriculture)	Regulatory	Implemented	Specify the requirements for storing of manure outside animal shed Requirements refer to farms with more than 10 AU (animal units), and 5 AU in vulnerable territories.	2014	Ministry of Agriculture (Government)	NE	NE	NE

Maintenance of amelioration systems*	Agriculture	N_2O	Other activities improving cropland management (Agriculture)	Voluntary Agreement	Implemented	Financial support for reconstruction or renovation of a drainage system is defined in Regulations of the Cabinet of Ministers No. 600 (2014), that establishing procedures for receiving payments for investments in the development of agricultural and forestry infrastructure. This will reduce N_2O emissions from use of synthetic and organic fertilizers.	2014	Ministry of Agriculture (Government)	NE	NE	NE
Reducing of biodegradable waste landfilling*	Waste management/waste	CH_4	Reduced landfilling (Waste)	Regulatory	Implemented	Decreasing of the maximum amount of biologically degradable municipal wastes deposited on landfills according to the Landfill Directive 99/31/EC. Till 2020 reduce biodegradable waste disposing till 35% of 1995 biodegradable waste amount. Mechanical Biological treatment and sorting of municipal wastes will be establish before waste disposal. Already MTB and sorting facilities operated in Latvia.	2006	Ministry of Environmental Protection and Regional Develepoment (Government)	NE	NE	NE
Increase of Municipal waste recycling*	Waste management/waste	CH_4	Enhanced recycling (Waste)	Regulatory	Implemented	50% recycling of wastes according to directive 2008/98/EC requirements. Increase of recycling is one of priorities in Latvia wastes management plans. Wastes recycling is done according the permits. All facilities which have permits on wastes management is obliged to provide data annually.	2012	Ministry of Environmental Protection and Regional Develepoment (Government)	NE	NE	NE
Reduce emissions of fluorinated greenhouse gases*	Industry/industrial processes	HFCs, PFCs, SF_6	Reduction of emissions of fluorinated gases (Industrial processes); Replacement of fluorinated gases by other substances (Industrial processes)	Regulatory	Implemented	Prevent and minimise emissions of fluorinated greenhouse gases. Bans on the placing on the market, maintenance and service products and equipment containing HFCs with high GWPs.	2015	Ministry of Environment and Regional Development (Government)	NE	NE	NE
Preferential Feed-in-tariffs for renewables utilising power	Energy	CO_2	The implementation of feed-in-tariff (FIT) system has started in 1996 as the	Economic	Implemented	Actual FIT system applies to existing RES electricity (wind, small hydro, biogas, solid biomass) and CHP (both RES and natural gas) plants only till	1996	Ministry of Economics (Government)	390.00	300.00	200.00

and combined heat-power production*			national policy to get both environmental benefits, socio-economic benefits by contributing in regional development and benefits in energy security; afterwards this policy was linked with EU energy and RES policies.			expire of FIT rights. WEM scenario envisages complex measures to further develop electricity market, including to decrease FIT support.					
Excise Tax - stationary combustion sources*	Energy	CO_2	Efficiency improvement in the energy and transformation sector (Energy supply); Reduction of losses (Energy supply); Increase in renewable energy (Energy supply); Efficiency improvements of buildings (Energy consumption); Efficiency improvement in industrial and services/tertiary end-use sectors (Energy consumption)	Fiscal	Implemented	The natural gas is the dominating fossil fuel in stationary combustion sources. The procedure of duty for natural gas is established by the Law "On Excise Duties" (Articles 6.1 & 15.1). The Articles 5 & 14 of the Law "On Excise Duties" establish the duty for mineral oils and their substitutes utilised for energy production. In its turn, the procedure of taxation applicable for coal, coke and lignite is prescribed by the Natural Resources Tax Law.	2010	Ministry of Finance (Government)	NE	NE	NE
Green Public Procurement*	Energy, Transport	CO_2	Efficiency improvements of buildings (Energy consumption); Efficiency improvement in services/ tertiary sector (Energy consumption); Efficiency improvement of appliances (Energy	Regulatory	Implemented	Public Procurement Law states procedure for application of specific requirements for energy efficiency. The minimum energy efficiency requirements for goods (including tyres) and services purchased by state central administration institutions are stated by the relevant Cabinet of Ministers Regulation. The Cabinet of Ministers Regulation on green public procurement is adopted as well and relates to electricity, energy consuming	2016	Ministry of Finance (Government); Ministry of Environmental Protection and Regional Development (Government); Ministry Of Economics	NE	NE	NE

			consumption); Low carbon fuels/electric cars (Transport)			goods and services, vehicles. In Transport sector, Public Transport Service Provider when purchasing road transport vehicles shall take into account the effect of the putting into operation thereof on energy and the environment, including CO_2 and noxious air emissions.		(Government); (Government)			
Energy Efficiency Obligation Scheme (EEOS)*	Energy	CO_2	Efficiency improvement of appliances (Energy consumption); Demand management/reduction (Energy consumption)	Regulatory	Implemented	The measure results in energy efficiency improvement in electricity end use. The obliged parties for the start and the 1st EEOS period (till 31.12.2020) are electricity retail sellers which had sold at least 10 GWh of electricity in 2016 or in any of years related to 1st EEOS period.	2017	Ministry of Economics (Government)	NE	NE	NE
Energy Management System in Commercial Sector*	Energy	CO_2	Demand management/reduction (Energy consumption); Efficiency improvement in industrial and services/ tertiary end-use sectors (Energy consumption);	Regulatory	Implemented	The Energy Efficiency Law defines: (1) Energy Audit in Large Enterprises (transposition of EU Energy Efficiency Directive 2012/27/EU) and (2) Energy Management System for merchants – Large Electricity Consumers (LEC) which have its own annual electricity consumption above 500 MWh (national measure). The large enterprises and the LECs shall provide annual report on implemented energy saving measures and reached energy savings. At least three energy efficiency measures which have the highest energy savings or the highest economical return shall be implemented both by large enterprises (up to the 1st April 2020) and by LECs (up to the 1st April 2022).	2017	Ministry of Economics (Government)	NE	NE	NE
Energy Management System (EMS) in Public Sector*	Energy	CO_2	Demand management/reduction (Energy consumption); Efficiency improvements of buildings (Energy consumption); Efficiency improvement in	Regulatory	Implemented	The Energy Efficiency Law defines: (1) Mandatory implementation of EMS in those state direct administration institutions which have buildings with total heating area 10000 m2 and above; (2) Mandatory implementation of EMS in Latvia (a) largest nine cities and (b) those municipalities which have the territorial development index 0.5 and above and population above 10 thousand inhabitants (10 municipalities in 2018). (3) other municipalities may	2017	Ministry of Economics (Government)	NE	NE	NE

			municipal end-use sector			implement EMS voluntary. Annual report on implemented energy efficiency measures and reached energy savings shall be submitted.					
Mandatory individual meters for consumers connected to District Heating Systems or supplied from a common heat source*	Energy	CO_2	Demand management/reduction (Energy consumption)	Regulatory, Information	Implemented	The installation of meters or heat cost allocators in multi-apartment and multi-purpose buildings that share the bill for the heat energy consumed, with a view to recording the amounts of heat energy consumed for heating purposes in each apartment or set of premises that is invoiced separately. These provisions are in force from 31 December 2016 and apply to new buildings and buildings to be renovated (if funded by EU funds, State or municipal budgets) for which a building permit has been issued after 1st January 2016.	2016	Ministry of Economics (Government)	NE	NE	NE
Investment Support Programme to Increase Energy Efficiency in Apartment Buildings: 2021-2027 EU Funds Programming Period	Energy	CO_2	Efficiency improvements of buildings (Energy consumption)	Economic	Planned	Continuation of the particular support programme in the apartment buildings sector in the following EU Funds period is envisaged by the national Energy-Climate Plan 2030. The given PAM has impact on district heat consumption especially in residential multi-flat buildings - a large number of Latvia district heating utilities participate in ETS sector. Thus given PAM has impact on both ETS and ESD (non-ETS) sectors.	2023	Ministry of Economics (Government)	NE	12.00	28.00
Investment Support Programme to Increase Energy Efficiency in State Central Government Buildings: 2021-2027 EU Funds programming period	Energy	CO_2	Efficiency improvements of buildings (Energy consumption)	Economic	Planned	Continuation of the particular support programme in the state direct administration buildings sector in the following EU Funds period is envisaged by the national Energy-Climate Plan 2030. The given PAM has impact on district heat consumption as large share of state buildings are connected to DH system. As a large number of Latvia district heating utilities participate in ETS sector, the given PAM has impact on both ETS and ESD (non-ETS) sectors.	2023	Ministry of Economics (Government)	NE	8.00	16.00

Increase of land area under organic farming relative to total agricultural land*	Agriculture	N_2O	Reduction of fertilizer/manure use on cropland (Agriculture); Other activities improving cropland management (Agriculture)	Economic	Implemented	Farming methods with environmentally friendly influence on nature, reduction of synthetic nitrate use and leaching, increased biodiversity. The state support for organic farmers through subsidies. National Development Plan of Latvia for 2014-2020 (NDP2020) set the plan to increase organic agriculture area to 15% by 2030 in relation to total agricultural area. The National Development Plan 2014–2020 is hierarchically the highest national-level medium-term planning document.	2014	Ministry of Agriculture (Government)	213.00	292.00	370.00
Future support to precision farming practices and practices promoting to reduce synthetic N use, including biogas production	Agriculture	N_2O, CH_4	Reduction of fertilizer/manure use on cropland (Agriculture); Improved livestock management (Agriculture); Improved animal waste management systems (Agriculture)	Economic	Planned	In financial period of 2021-2027 the support for precise fertilization techniques; farm animal feed quality improving and planning; maintenance of drainage systems; fertilization planning; the promotion of biogas production and leguminous plants introduction will be more available.	2021	Ministry of Agriculture (Government)	NE	NE	NE
Development and adaptation of drainage systems in cropland*	Forestry/LULUCF	CO_2, CH_4	Other activities improving cropland management (Other LULUCF)	Economic	Implemented	Restoration of malfunctioning drainage systems in cropland. The measure will be implemented in extensively managed croplands on mineral soils, where high yields are not possible due to unfavorable conditions during spring time, which are caused by wearing of existing drainage systems. After reconstruction of drainage systems fields will be returned to a conventional production systems with considerable input of organic material in soil due to higher yields and crop rotations. Only CO_2 is considered due to the fact that country specific methods for accounting of reduction of CH4 are not elaborated and use of the default IPCC values might lead to considerable overestimation of impact of the measure.	2015	Ministry of Agriculture (Government)	6.10	6.10	6.10

Support to introduction and promotion of integrated horticulture*	Forestry/LULUCF	CO_2	Increase of carbon stock in cropland (Other LULUCF)	Economic	Implemented	The measure is aimed of maintenance of area of the orchards. Without financial support area of orchards would reduce resulting in reduction of carbon stock in affected areas.	2015	Ministry of Agriculture (Government)	4.50	4.50	4.50
Growing of legumes*	Forestry/LULUCF	CO_2	Increase of soil carbon stock (Other LULUCF)	Economic	Implemented	Support to use of legumes as green manure and fodder in crop rotation.	2015	Ministry of Agriculture (Government)	66.10	66.10	66.10
Maintenance of biodiversity in grasslands*	Forestry/LULUCF	CO_2	Improved management of organic soils (Other LULUCF)	Economic	Implemented	Leaving a certain area of cropland out of conventional cropping system, if the area is not afforested or used for perennial crop production, in general will not lead to reduction of the GHG emissions or increase of CO_2 removals. The aim is to reduce GHG emissions by reduction of management activities on organic soil.	2015	Ministry of Agriculture (Government)	13.70	13.70	13.70
Development and adaptation of drainage systems in forest land*	Forestry/LULUCF	CO_2	Retaining high productivity in forests (Other LULUCF)	Economic	Implemented	Restoration of malfunctioning forest drainage systems.	2015	Ministry of Agriculture (Government)	15.60	15.60	15.60
Afforestation and improvement of stand quality in naturally afforested areas*	Forestry/LULUCF	CO_2	Afforestation and reforestation (LULUCF)	Economic	Implemented	Support to afforestation of low grade abandoned farmlands.	2016	Ministry of Agriculture (Government)	48.70	48.70	48.70
Regeneration of forest stands after natural disasters*	Forestry/LULUCF	CO_2	Improving forest management (Other LULUCF)	Economic	Implemented	The measure considers restoration of forest stands after natural disturbances, like forest fires and strong storms, as well as reconstruction of diseasing valueless forest stands. The measure will affect mainly carbon stock in living biomass and dead wood carbon pools.	2016	Ministry of Agriculture (Government)	18.20	18.20	18.20
Improvement of ecological value and sustainability of	Forestry/LULUCF	CO_2	Improve forest management (Other LULUCF)	Economic	Implemented	The scope of the measure is to support pre-commercial thinning of young stands in private forests to secure implementation of sustainable forest	2016	Ministry of Agriculture (Government)	28.10	28.10	28.10

forest ecosystems*						management practices aimed to increase economic and ecological value of forests in long term. According to the study results (the research programme on impact of forest management measures on GHG emissions and CO_2 removals 2011-2015) early thinning in coniferous stands, as it is done now according to national regulations, contributes to additional increment during 20 years period; respectively, growing stock in 40-60 years old coniferous stands and research trials is by 15-25% higher than in non-thinned stands. Private forest owners are not motivated to implement early thinning due to the fact that is is not resulting in direct incomes, therefore, this measure is oftenly avoided to save money. Support to forest thinning will result in rapid and significant increase of carbon stock.					
Reconstruction and development of drainage systems in cropland	Forestry/LULUCF	CO_2	Retaining of high productivity in croplands (Other LULUCF)	Economic	Planned	Restoration and maintenance of drainage systems in cropland. The measure will be implemented in croplands on mineral soils, where high yields are possible due to drainage and wearing out of the drainage systems will lead to reduction of carbon input. After reconstruction of drainage systems fields will be maintained as a conventional production systems with considerable input of organic material in soil due to higher yields and crop rotations. Only CO_2 is considered due to the fact that country specific methods for accounting of reduction of CH_4 are not elaborated and use of the default IPCC values might lead to considerable overestimation of impact of the measure.	2021	Ministry of Agriculture (Government)	NE	NE	NE
Establishment of new orchards	Forestry/LULUCF	CO_2	Increase of carbon stock in cropland (Other LULUCF)	Economic	Planned	The measure is aimed of maintenance of area of the orchards. Without financial support area of orchards	2021	Ministry of Agriculture (Government)	NE	NE	15.00

						would reduce resulting in reduction of carbon stock in affected areas.					
Undergrowth plants sown with winter crops	Forestry/LULUCF	CO_2	Increase of carbon stock in soils (Other LULUCF)	Economic	Planned	More efficient utilization of nutrients and increase of carbon input in soil due to prolongation of vegetation period.	2021	Ministry of Agriculture (Government)	NE	NE	127.00
Green fallow before winter crops	Forestry/LULUCF	CO_2	Increase of carbon stock in soils (Other LULUCF)	Economic	Planned	Increased carbon stock in soil due to increase of efficient vegetation period and bigger carbon input in soil. The measure is efficient in case if fallows are used before winter crops.	2021	Ministry of Agriculture (Government)	NE	NE	73.00
Introduction of legumes into conventional crop rotations	Forestry/LULUCF	CO_2	Increase of carbon stock in soils (Other LULUCF)	Economic	Planned	Increase of carbon stock in soils due to increase of carbon input into soil with biomass	2021	Ministry of Agriculture (Government)	NE	NE	242.00
Reconstruction of drainage systems in forest land	Forestry/LULUCF	CO_2	Improving forest management (Other LULUCF)	Economic	Planned	Restoration of malfunctioning drainage systems and preventive maintenance of drainage ditches, which secures continuously high removals of CO_2 in following forest generation.	2021	Ministry of Agriculture (Government)	NE	NE	284.00
Afforestation of nutrient-poor soils in grassland and cropland	Forestry/LULUCF	CO_2	Improving forest management (Other LULUCF)	Economic	Planned	Increase of carbon stock in soil, living and dead biomass pools by afforestation of low grade croplands and grasslands.	2021	Ministry of Agriculture (Government)	NE	NE	189.00
Pre-commercial thinning	Forestry/LULUCF	CO_2	Improving forest management (Other LULUCF)	Economic	Planned	Support to pre-commercial thinning of forest stands to contribute to additional increment during 20 years period; growing stock in 40-60 years old coniferous stands and research trials is by 15-25% higher than in non-thinned stands. Support to forest thinning will result in rapid and significant increase of carbon stock.	2021	Ministry of Agriculture (Government)	NE	NE	884.00
Regeneration of forest stands suffered by natural disturbances	Forestry/LULUCF	CO_2	Improving forest management (Other LULUCF)	Economic	Planned	Support to reconstruction and regeneration of forest stands damaged by natural disasters like wind and fire.	2021	Ministry of Agriculture (Government)	NE	NE	30.00

Note: The two final columns specify the year identified by the Party for estimating impacts (based on the status of the measure and whether an ex post or ex ante estimation is available).
Abbreviations: GHG = greenhouse gas; LULUCF = land use, land-use change and forestry.
[a] Parties should use an asterisk (*) to indicate that a mitigation action is included in the 'with measures' projection.
[b] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors, cross-cutting, as appropriate.
[c] To the extent possible, the following types of instrument should be used: economic, fiscal, voluntary agreement, regulatory, information, education, research, other.
[d] To the extent possible, the following descriptive terms should be used to report on the status of implementation: implemented, adopted, planned.
[e] Additional information may be provided on the cost of the mitigation actions and the relevant timescale.
[f] Optional year or years deemed relevant by the Party.

CTF Table 4: Reporting on progress

Table 4 LVA_BR4_v0.1

Reporting on progress[a,b]

	Total emissions excluding LULUCF	*Contribution from LULUCF*[d] *(1)*	*Quantity of units from market based mechanisms under the Convention*		*Quantity of units from other market based mechanisms*	
Year[c]	*(kt CO_2 eq)*	*(kt CO_2 eq)*	*(number of units)*	*(kt CO_2 eq)*	*(number of units)*	*(kt CO_2 eq)*
Base year/period (1990)	26,299.76	NA*	NA*	NA*	NA*	NA*
1990	26,299.76	NA*	NA	NA	NA	NA
2010	12,295.27	NA*	NA	NA	NA	NA
2011	11,500.13	NA*	NA	NA	NA	NA
2012	11,339.98	NA*	NA	NA	NA	NA
2013	11,275.18	NA*	NA	NA	NA	NA
2014	11,194.04	NA*	NA	NA	NA	NA
2015	11,272.95	NA*	NA	NA	NA	NA
2016	11,286.49	NA	NA*	NA*	NA	NA
2017	11,325.33	NA	NA*	NA*	NA	NA
2018	NA*	NA*	NA	NA	NA	NA

Abbreviation: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] For the base year, information reported on the emission reduction target shall include the following: (a) total GHG emissions, excluding emissions and removals from the LULUCF sector; (b) emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the Conference of the Parties and the activities and/or land that will be accounted for; (c) total GHG emissions, including emissions and removals from the LULUCF sector. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraphs 9(a–c) of the UNFCCC biennial reporting guidelines for developed country Parties, information on the use of units from market-based mechanisms.

[c] Parties may add additional rows for years other than those specified below.

[d] Information in this column should be consistent with the information reported in table 4(a)I or 4(a)II, as appropriate. The Parties for which all relevant information on the LULUCF contribution is reported in table 1 of this common tabular format can refer to table 1.

Custom Footnotes

(1) Numbers for LULUCF are not reported because this sector is not included under the Convention target

Table 4(a)I LVA_BR4_v0.1

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

	Net GHG emissions/removals from LULUCF categories [c]	*Base year/period or reference level value [d]*	*Contribution from LULUCF for reported year*	*Cumulative contribution from LULUCF [e]*	*Accounting approach [f]*
	(kt CO_2 eq)				
Total LULUCF	NA	NA	NA	NA	
A. Forest land	NA	NA	NA	NA	
1. Forest land remaining forest land	NA	NA	NA	NA	
2. Land converted to forest land	NA	NA	NA	NA	
3. Other [g]					
B. Cropland	NA	NA	NA	NA	
1. Cropland remaining cropland	NA	NA	NA	NA	
2. Land converted to cropland	NA	NA	NA	NA	
3. Other [g]					
C. Grassland	NA	NA	NA	NA	
1. Grassland remaining grassland	NA	NA	NA	NA	
2. Land converted to grassland	NA	NA	NA	NA	
3. Other [g]					
D. Wetlands	NA	NA	NA	NA	
1. Wetland remaining wetland	NA	NA	NA	NA	
2. Land converted to wetland	NA	NA	NA	NA	
3. Other [g]					
E. Settlements	NA	NA	NA	NA	
1. Settlements remaining settlements	NA	NA	NA	NA	
2. Land converted to settlements	NA	NA	NA	NA	
3. Other [g]					
F. Other land	NA	NA	NA	NA	
1. Other land remaining other land	NA	NA	NA	NA	
2. Land converted to other land	NA	NA	NA	NA	
3. Other [g]					
G. Other	NA	NA	NA	NA	
Harvested wood products	NA	NA	NA	NA	

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

[c] For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for the reporting under the Convention or its Kyoto Protocol, explain in the biennial report how the value was derived.

[d] Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

[e] If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

[f] Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant accounting parameters (i.e. natural disturbances, caps).

[g] Specify what was used for the category "other". Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or its Kyoto Protocol.

Table 4(a)I LVA_BR4_v0.1

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

	Net GHG emissions/removals from LULUCF categories [c]	*Base year/period or reference level value [d]*	*Contribution from LULUCF for reported year*	*Cumulative contribution from LULUCF [e]*	*Accounting approach [f]*
	(kt CO_2 eq)				
Total LULUCF	NA	NA	NA	NA	
A. Forest land	NA	NA	NA	NA	
1. Forest land remaining forest land	NA	NA	NA	NA	
2. Land converted to forest land	NA	NA	NA	NA	
3. Other [g]					
B. Cropland	NA	NA	NA	NA	
1. Cropland remaining cropland	NA	NA	NA	NA	
2. Land converted to cropland	NA	NA	NA	NA	
3. Other [g]					
C. Grassland	NA	NA	NA	NA	
1. Grassland remaining grassland	NA	NA	NA	NA	
2. Land converted to grassland	NA	NA	NA	NA	
3. Other [g]					
D. Wetlands	NA	NA	NA	NA	
1. Wetland remaining wetland	NA	NA	NA	NA	
2. Land converted to wetland	NA	NA	NA	NA	
3. Other [g]					
E. Settlements	NA	NA	NA	NA	
1. Settlements remaining settlements	NA	NA	NA	NA	
2. Land converted to settlements	NA	NA	NA	NA	
3. Other [g]					
F. Other land	NA	NA	NA	NA	
1. Other land remaining other land	NA	NA	NA	NA	
2. Land converted to other land	NA	NA	NA	NA	
3. Other [g]					
G. Other	NA	NA	NA	NA	
Harvested wood products	NA	NA	NA	NA	

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

[c] For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for the reporting under the Convention or its Kyoto Protocol, explain in the biennial report how the value was derived.

[d] Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

[e] If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

[f] Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant accounting parameters (i.e. natural disturbances, caps).

[g] Specify what was used for the category "other". Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or its Kyoto Protocol.

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, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Table 4(a)II LVA_BR4_v0.1

Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol[a, b, c]

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	*Base year*[d]	*Net emissions/removals*[e]									*Accounting parameters*[h]	*Accounting quantity*[i]
		2013	2014	*2015*	*2016*	2017	2018	2019	2020	Total[g]		
	(kt CO_2 eq)											
A. Article 3.3 activities												
A.1. Afforestation/reforestation		-132.38	-142.89	-152.94	-163.21	-171.41				-762.83		-762.83
Excluded emissions from natural disturbances(5)		NA	NA	NA	NA	NA				NA		NA
Excluded subsequent removals from land subject to natural disturbances(6)		NA	NA	NA	NA	NA				NA		NA
A.2. Deforestation		339.18	345.69	351.84	358.18	363.97				1,758.87		1758.87
B. Article 3.4 activities												
B.1. Forest management										-18,078.99		4914.05
Net emissions/removalse		-6,481.98	-743.74	-2,566.87	-3,673.79	-4,612.60				-18,078.99		
Excluded emissions from natural disturbances(5)		NA	NA	NA	NA	NA				NA		NA
Excluded subsequent removals from land subject to natural disturbances(6)		NA	NA	NA	NA	NA				NA		NA
Any debits from newly established forest (CEF-ne)(7),(8)		NA	NA	NA	NA	NA				NA		NA
Forest management reference level (FMRL)(9)											-16302.00	
Technical corrections to FMRL(10)											11703.39	
Forest management capl											7364.68	4914.05
B.2. Cropland management (if elected)	NA	NA	NA	NA	NA	NA				NA		NA
B.3. Grazing land management (if elected)	NA	NA	NA	NA	NA	NA				NA		NA
B.4. Revegetation (if elected)	NA	NA	NA	NA	NA	NA				NA		NA
B.5. Wetland drainage and rewetting (if elected)	NA	NA	NA	NA	NA	NA				NA		NA

Note: 1 kt CO_2 eq equals 1 Gg CO_2 eq.

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] Developed country Parties with a quantified economy-wide emission reduction target as communicated to the secretariat and contained in document FCCC/SB/2011/INF.1/Rev.1 or any update to that document, that are Parties to the Kyoto Protocol, may use table 4(a)II for reporting of accounting quantities if LULUCF is contributing to the attainment of that target.

[c] Parties can include references to the relevant parts of the national inventory report, where accounting methodologies regarding LULUCF are further described in the documentation box or in the biennial reports.

[d] Net emissions and removals in the Party's base year, as established by decision 9/CP.2.

[e] All values are reported in the information table on accounting for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, of the CRF for the relevant inventory year as reported in the current submission and are automatically entered in this table.

[f] Additional columns for relevant years should be added, if applicable.

[g] Cumulative net emissions and removals for all years of the commitment period reported in the current submission.

[h] The values in the cells "3.3 offset" and "Forest management cap" are absolute values.

[i] The accounting quantity is the total quantity of units to be added to or subtracted from a Party's assigned amount for a particular activity in accordance with the provisions of Article 7, paragraph 4, of the Kyoto Protocol.

[j] In accordance with paragraph 4 of the annex to decision 16/CMP.1, debits resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than the credits accounted for on that unit of land.

[k] In accordance with paragraph 10 of the annex to decision 16/CMP.1, for the first commitment period a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3 paragraph 3, may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

[l] In accordance with paragraph 11 of the annex to decision 16/CMP.1, for the first commitment period of the Kyoto Protocol only, additions to and subtractions from the assigned amount of a Party resulting from Forest management under Article 3, paragraph 4, after the application of paragraph 10 of the annex to decision 16/CMP.1 and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

CTF Table 4(b): Reporting on progress

Table 4(b) LVA_BR4_v0.1

Reporting on progress[a, b, c]

Units of market based mechanisms			*Year*	
			2017	*2018*
Kyoto Protocol units[d]	*Kyoto Protocol units*	*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA
	AAUs	*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA
	ERUs	*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA
	CERs	*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA
	tCERs	*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA
	lCERs	*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA
Other units [d,e]	*Units from market-based mechanisms under the Convention*	*(number of units)*		
		(kt CO_2 eq)		
	Units from other market-based mechanisms	*(number of units)*		
		(kt CO_2 eq)		
Total		*(number of units)*	NA	NA
		(kt CO_2 eq)	NA	NA

Abbreviations: AAUs = assigned amount units, CERs = certified emission reductions, ERUs = emission reduction units, lCERs = long-term certified emission reductions, tCERs = temporary certified emission reductions.

Note: 2011 is the latest reporting year.

[a] Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

[b] For each reported year, information reported on progress made towards the emission reduction target shall include, in addition to the information noted in paragraphs 9(a-c) of the reporting guidelines, on the use of units from market-based mechanisms.

[c] Parties may include this information, as appropriate and if relevant to their target.

[d] Units surrendered by that Party for that year that have not been previously surrendered by that or any other Party.

[e] Additional rows for each market-based mechanism should be added, if applicable.

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

LVA_BR4_v0.1

Table 5

Summary of key variables and assumptions used in the projections analysis[a]

Key underlying assumptions		*Historical*[b]							Projected				
Assumption	*Unit*	*1990*	*1995*	2000	2005	2010	2015	2016	2017	2018	2020	2025	2030
Population	*thousands*						1,977.53	1,959.54	1,942.25	1,923.30	1,877.60	1,751.41	1,634.37
Gross domestic product, constant prices	MEUR (2010)						21,328.18	21,768.48	22,777.77	23,680.26	25,170.29	28,499.90	31,522.76
Gross value added industry, constant prices	MEUR (2010)						2,722.04	2,856.91	3,108.44	3,274.59	3,477.00	3,980.23	4,460.34
EU ETS carbon price	EUR(2000)/EUA						5.74	6.89	8.04	9.19	11.48	17.22	25.64
Coal import price	EUR(2000)/GJ						2.74	2.65	2.56	2.47	2.30	2.55	2.83
Crude oil import price	EUR(2000)/GJ						4.62	5.19	5.76	6.33	7.47	9.29	11.56
Natural gas import price	EUR(2000)GJ						5.71	5.78	5.85	5.92	6.06	7.47	9.21
Number of passenger-kilometres (all modes)	Mpkm						16,911.98	17,186.33	17,198.33	17,480.20	18,043.96	18,771.99	19,214.43
Freight transport tonnes-kilometres (all modes)	Mtkm						33,596.00	30,100.00	29,986.00	30,423.73	31,299.18	32,947.47	34,297.84
Number of heating degree days (HDD)	count						3,695.33	4,002.70	4,016.22	4,016.22	4,016.22	4,016.22	4,016.22
Number of households	thousands						796.00	822.00	818.06	812.00	800.63	761.41	724.22
Household size (inhabitants/Household)	count						2.48	2.38	2.37	2.37	2.35	2.30	2.26
Livestock - Dairy cattle	1000						162.40	154.00	150.40	150.10	147.30	155.90	151.60
Livestock - Non-dairy cattle	1000						256.70	258.30	255.40	279.00	296.60	333.00	328.60
Livestock - Sheep	1000						102.30	106.60	112.20	116.30	124.00	140.70	154.90
Livestock - Pig	1000						334.20	336.40	320.60	305.80	307.90	298.70	291.60
Livestock - Poultry	1000						4,532.00	4,712.00	4,944.00	4,951.60	5,010.70	5,137.00	5,240.90
Nitrogen input from application of synthetic fertilizers	kt N						75.80	78.30	77.40	80.20	83.30	87.80	90.50
Nitrogen input from application of manure	kt N						16.26	15.75	15.45	15.78	15.97	17.22	17.17
Nitrogen in crop residues returned to soils	kt N						44.68	42.12	42.12	40.32	45.69	49.16	51.67
Area of cultivated organic soils	Ha						154.17	152.23	152.16	149.71	149.26	149.26	149.26
Municipal solid waste (MSW) generation	1000t						NE	NE	NE	NE	NE	NE	NE
Municipal solid waste (MSW) going to landfills	1000t						503.00	353.00	222.00	200.00	200.00	150.00	150.00
Share of CH_4 recovery in total CH_4 generation from landfills	%						33.86	30.80	30.69	31.68	33.61	43.33	53.62

Primary energy consumption - Coal	PJ						4.26	3.25	3.70	3.61	3.42	2.62	2.61
Primary energy consumption - petroleum products	PJ						62.64	62.64	62.64	63.40	64.92	62.23	57.78
Primary energy consumption - Natural gas	PJ						46.10	47.21	41.67	45.89	54.34	49.39	41.85
Primary energy consumption - Renewables	PJ						64.37	67.96	80.07	75.98	67.80	67.41	65.26
Primary energy consumption - Total	PJ						177.37	181.06	188.08	188.88	190.48	181.65	167.49
Gross electricity production - Coal	TWh						0.00	0.00	0.00	0.00	0.00	0.00	0.02
Gross electricity production - Oil	TWh						0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross electricity production - Natural gas	TWh						2.76	2.94	2.07	2.36	2.94	2.71	2.07
Gross electricity production - Renewables	TWh						2.78	3.48	5.46	5.01	4.12	4.29	4.04
Gross electricity production - Total	TWh						5.53	6.43	7.53	7.37	7.06	7.00	6.12
Total net electricity imports	TWh						1.82	1.03	-0.06	0.20	0.72	1.29	1.94
Final energy consumption - Industry	PJ						33.04	31.44	33.20	34.13	35.97	39.67	40.83
Final energy consumption - Transport	PJ						48.02	48.42	51.11	50.67	49.79	49.39	47.07
Final energy consumption - Residential	PJ						46.30	47.94	50.12	49.15	47.20	42.82	40.24
Final energy consumption - Agriculture/Forestry	PJ						6.77	7.38	8.19	8.35	8.68	9.24	9.42
Final energy consumption - Services	PJ						24.63	24.94	25.46	25.63	25.97	23.63	23.24
Final energy consumption - Total	*PJ*						158.75	160.11	168.08	167.92	167.61	164.74	160.80

[a] Parties should include key underlying assumptions as appropriate.

[b] Parties should include historical data used to develop the greenhouse gas projections reported.

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

Table 6(a) LVA_BR4_v0.1

Information on updated greenhouse gas projections under a 'with measures' scenario[a]

	GHG emissions and removals[b] (kt CO_2 eq)								GHG emission projections (kt CO_2 eq)	
	Base year (1990)	1990	1995	2000	2005	2010	2015	2017	2020	2030
Sector[d,e]										
Energy	16,248.52	16,248.52	7,357.98	5,100.19	4,945.06	5,174.72	4,018.53	3,900.06	4,504.89	3,452.41
Transport	3,040.44	3,040.44	2,105.07	2,213.13	3,109.36	3,273.41	3,150.53	3,325.12	3,075.55	2,771.31
Industry/industrial processes	654.31	654.31	210.92	234.55	319.54	700.31	755.16	733.48	756.11	756.29
Agriculture	5,616.57	5,616.57	2,595.97	2,248.85	2,384.47	2,480.26	2,769.93	2,782.32	2,879.46	3,102.07
Forestry/LULUCF	-9,828.92	-9,828.92	-12,375.33	-8,751.41	-3,184.96	77.63	1,696.83	-1,706.85	2,093.91	4,636.20
Waste management/waste	699.62	699.62	623.34	691.04	629.50	650.54	561.77	565.21	536.16	326.20
Other (specify)										
Gas										
CO_2 emissions including net CO_2 from LULUCF	8,599.30	8,599.30	-4,360.68	-2,782.31	3,593.46	7,580.26	7,853.57	4,377.56	8,741.57	10,000.31
CO_2 emissions excluding net CO_2 from LULUCF	19,504.91	19,504.91	9,090.49	7,065.17	7,812.76	8,553.97	7,278.85	7,235.24	7,721.53	6,456.36
CH_4 emissions including CH_4 from LULUCF	4,036.32	4,036.32	2,582.96	2,313.38	2,223.56	2,173.52	2,235.39	2,337.87	2,240.52	2,130.53
CH_4 emissions excluding CH_4 from LULUCF	3,537.27	3,537.27	2,087.52	1,808.05	1,787.44	1,728.91	1,728.11	1,804.63	1,780.95	1,655.46
N_2O emissions including N_2O from LULUCF	3,794.92	3,794.92	2,293.01	2,190.32	2,327.17	2,429.68	2,634.13	2,638.67	2,622.58	2,713.13
N_2O emissions excluding N_2O from LULUCF	3,217.28	3,217.28	1,712.61	1,599.58	1,728.95	1,822.94	2,019.29	2,021.09	2,008.28	2,095.95
HFCs	NO, NE, NA	NO, NE, NA	2.50	14.08	55.00	166.06	219.56	234.92	231.21	190.42
PFCs	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
SF_6	NO, NA	NO, NA	0.17	0.88	3.78	7.35	10.12	10.32	10.19	10.10
NF_3	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Other (specify)										
Total with LULUCF[f]	16,430.54	16,430.54	517.96	1,736.35	8,202.97	12,356.87	12,952.77	9,599.34	13,846.07	15,044.49
Total without LULUCF	26,259.46	26,259.46	12,893.29	10,487.76	11,387.93	12,279.23	11,255.93	11,306.20	11,752.16	10,408.29

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

[b] Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

[c] 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

[d] In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

[e] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

[f] Parties may choose to report total emissions with or without LULUCF, as appropriate.

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

Table 6(c) LVA_BR4_v0.1

Information on updated greenhouse gas projections under a 'with additional measures' scenario[a]

	GHG emissions and removals[b] (kt CO_2 eq)								GHG emission projections (kt CO_2 eq)	
	Base year (1990)	1990	1995	2000	2005	2010	2015	2017	2020	2030
Sector[d,e]										
Energy	16,248.52	16,248.52	7,357.98	5,100.19	4,945.06	5,174.72	4,018.53	3,900.06	4,330.34	3,408.74
Transport	3,040.44	3,040.44	2,105.07	2,213.13	3,109.36	3,273.41	3,150.53	3,325.12	3,075.55	2,771.31
Industry/industrial processes	654.31	654.31	210.92	234.55	319.54	700.31	755.16	733.48	756.11	756.29
Agriculture	5,616.57	5,616.57	2,595.97	2,248.85	2,384.47	2,480.26	2,769.93	2,782.32	2,879.46	3,009.71
Forestry/LULUCF	-9,828.92	-9,828.92	-12,375.33	-8,751.41	-3,184.96	77.63	1,696.83	-1,706.85	2,093.91	4,300.74
Waste management/waste	699.62	699.62	623.34	691.04	629.50	650.54	561.77	565.21	536.16	316.15
Other (specify)										
Gas										
CO_2 emissions including net CO_2 from LULUCF	8,599.30	8,599.30	-4,360.68	-2,782.31	3,593.46	7,580.26	7,853.57	4,377.56	8,587.88	9,641.77
CO_2 emissions excluding net CO_2 from LULUCF	19,504.91	19,504.91	9,090.49	7,065.17	7,812.76	8,553.97	7,278.85	7,235.24	7,567.84	6,433.28
CH_4 emissions including CH_4 from LULUCF	4,036.32	4,036.32	2,582.96	2,313.38	2,223.56	2,173.52	2,235.39	2,337.87	2,220.84	2,115.27
CH_4 emissions excluding CH_4 from LULUCF	3,537.27	3,537.27	2,087.52	1,808.05	1,787.44	1,728.91	1,728.11	1,804.63	1,761.26	1,640.20
N_2O emissions including N_2O from LULUCF	3,794.92	3,794.92	2,293.01	2,190.32	2,327.17	2,429.68	2,634.13	2,638.67	2,621.40	2,605.39
N_2O emissions excluding N_2O from LULUCF	3,217.28	3,217.28	1,712.61	1,599.58	1,728.95	1,822.94	2,019.29	2,021.09	2,007.09	1,988.21
HFCs	NO, NE, NA	NO, NE, NA	2.50	14.08	55.00	166.06	219.56	234.92	231.21	190.42
PFCs	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
SF_6	NO, NA	NO, NA	0.17	0.88	3.78	7.35	10.12	10.32	10.19	10.10
NF_3	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
Other (specify)										
Total with LULUCF[f]	16,430.54	16,430.54	517.96	1,736.35	8,202.97	12,356.87	12,952.77	9,599.34	13,671.52	14,562.95
Total without LULUCF	26,259.46	26,259.46	12,893.29	10,487.76	11,387.93	12,279.23	11,255.93	11,306.20	11,577.59	10,262.21

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

[b] Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

[c] 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

[d] In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and

measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

[e] To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

[f] Parties may choose to report total emissions with or without LULUCF, as appropriate.

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

Table 7 LVA_BR4_v0.1

Provision of public financial support: summary information in 2017[a]

Allocation channels	*Year*									
	European euro - EUR					*USD[b]*				
	Core/ general[c, 1]	*Climate-specific[d, 2]*				*Core/ general[c, 1]*	*Climate-specific[d, 2]*			
		Mitigation	*Adaptation*	*Cross-cutting[e]*	*Other[f]*		*Mitigation*	*Adaptation*	*Cross-cutting[e]*	*Other[f]*
Total contributions through multilateral channels:										
Multilateral climate change funds[g]										
Other multilateral climate change funds[h]										
Multilateral financial institutions, including regional development banks										
Specialized United Nations bodies										
Total contributions through bilateral, regional and other channels				24,993.00					28,234.12	
Total				24,993.00					28,234.12	

Note: Explanation of numerical footnotes is provided in the documentation box after tables 7, 7(a) and 7(b).

Abbreviation: USD = United States dollars.

[a] Parties should fill in a separate table for each year, namely 2015 and 2016, where 2018 is the reporting year.

[b] Parties should provide an explanation of the methodology used for currency exchange for the information provided in tables 7, 7(a) and 7(b) in the documentation box.

[c] This refers to support to multilateral institutions that Parties cannot specify as being climate-specific.

[d] Parties should explain in their biennial reports how they define funds as being climate-specific.

[e] This refers to funding for activities that are cross-cutting across mitigation and adaptation.

[f] Please specify.

[g] Multilateral climate change funds listed in paragraph 17(a) of the "UNFCCC biennial reporting guidelines for developed country Parties" in decision 2/CP.17.

[h] Other multilateral climate change funds as referred in paragraph 17(b) of the "UNFCCC biennial reporting guidelines for developed country Parties" in decision 2/CP.17.

Table 7

Provision of public financial support: summary information in 2018[a]

Allocation channels	*Year*									
	European euro - EUR					*USD[b]*				
	Core/ general[c, 1]	*Climate-specific[d, 2]*				*Core/ general[c, 1]*	*Climate-specific[d, 2]*			
		Mitigation	*Adaptation*	*Cross-cutting[e]*	*Other[f]*		*Mitigation*	*Adaptation*	*Cross-cutting[e]*	*Other[f]*
Total contributions through multilateral channels:										
Multilateral climate change funds[g]										
Other multilateral climate change funds[h]										
Multilateral financial institutions, including regional development banks										
Specialized United Nations bodies										
Total contributions through bilateral, regional and other channels				39,437.00					46,573.30	
Total				39,437.00					46,573.30	

Note: Explanation of numerical footnotes is provided in the documentation box after tables 7, 7(a) and 7(b).

Abbreviation: USD = United States dollars.

[a] Parties should fill in a separate table for each year, namely 2015 and 2016, where 2018 is the reporting year.

[b] Parties should provide an explanation of the methodology used for currency exchange for the information provided in tables 7, 7(a) and 7(b) in the documentation box.

[c] This refers to support to multilateral institutions that Parties cannot specify as being climate-specific.

[d] Parties should explain in their biennial reports how they define funds as being climate-specific.

[e] This refers to funding for activities that are cross-cutting across mitigation and adaptation.

[f] Please specify.

[g] Multilateral climate change funds listed in paragraph 17(a) of the "UNFCCC biennial reporting guidelines for developed country Parties" in decision 2/CP.17.

[h] Other multilateral climate change funds as referred in paragraph 17(b) of the "UNFCCC biennial reporting guidelines for developed country Parties" in decision 2/CP.17.

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

No information provided in Table 7(a).

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

No information provided in Table 7(a).

CTF Table 7(b): Provision of public financial support: contribution through bilateral, regional and other channels

Table 7(b) LVA_BR4_v0.1

Provision of public financial support: contribution through bilateral, regional and other channels in 2017[a]

Recipient country/ region/project/programme[b]	*Total amount*		*Status[c, 3]*	*Funding source[g, 4]*	*Financial instrument[g, 5]*	*Type of support[g, h, 6]*	*Sector[d, g, 7]*	*Additional information[e]*
	Climate-specific[f, 2]							
	European euro - EUR	*USD*						
Total contributions through bilateral, regional and other channels	24,993.00	28,234.12						
Uzbekistan / The project "Support of the Latvian Clean Technology Cluster Cleantech Latvia for the Capacity Building of Regional Municipalities (hakimat) in Rural Areas of Uzbekistan"	24,993.00	28,234.12	Disbursed	ODA	Grant	Cross-cutting	Energy, Cross-cutting, Water and sanitation	The training courses were based on the development needs of each specific region, but focused on 5 key topics - sustainable environmental planning, water management, municipal waste management and recycling, eco-friendly urban and regional environmental planning, bio-waste recycling for further use (including solutions for the recycling of agricultural and other biowaste using biogas and cogeneration) Latvia joined Eurozone 1 January, 2014. According to the Bank of Latvia, the average EUR / USD rate in 2017 was 1,12968118. (https://www.bank.lv/statistika/dati-statistika/valutu-kursi/ecb-kursu-videja-vertiba?view=graph&layout=currencyconverter&tmpl=component&ecb=1&action=average&dateFrom=01.01.2017&dateTo=31.12.2017)

Abbreviations: ODA = official development assistance, OOF = other official flows; USD = United States dollars.

[a] Parties should fill in a separate table for each year, namely 2015 and 2016, where 2018 is the reporting year.

[b] Parties should report, to the extent possible, on details contained in this table.

[c] Parties should explain, in their biennial reports, the methodologies used to specify the funds as disbursed and committed. Parties will provide the information for as many status categories as appropriate in the following order of priority: disbursed and committed.

[d] Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under "Other".

[e] Parties should report, as appropriate, on project details and the implementing agency.

[f] Parties should explain in their biennial reports how they define funds as being climate-specific.

[g] Please specify.

[h] This refers to funding for activities that are cross-cutting across mitigation and adaptation.

Table 7(b)

Provision of public financial support: contribution through bilateral, regional and other channels in 2018[a]

Recipient country/ region/project/programme[b]	*Total amount*		*Status[c, 3]*	*Funding source[g, 4]*	*Financial instrument[g, 5]*	*Type of support[g, h, 6]*	*Sector[d, g, 7]*	*Additional information[e]*
	Climate-specific[f, 2]							
	European euro - EUR	*USD*						
Total contributions through bilateral, regional and other channels	39,437.00	46,573.30						
Uzbekistan / The project "Capacity Building for Sustainable Development in Uzbekistan's Public Administration"	39,437.00	46,573.30	Disbursed	ODA	Grant	Cross-cutting	Energy, Agriculture	The project included training and consultations on energy efficiency, alternative energy and sustainable and safe agriculture for responsible officials and specialists involved in public administration in order to increase their capacity and raise awareness of the importance of sustainable development in improving the national economy. Latvia joined Eurozone 1 January, 2014. According to the Bank of Latvia, the average EUR / USD rate in 2018 was 1,18095451.(https://www.bank.lv/statistika/dati-statistika/valutu-kursi/ecb-kursu-videja-vertiba?view=graph&layout=currencyconverter&tmpl=component&ecb=1&action=average&dateFrom=01.01.2018&dateTo=31.12.2018)

Abbreviations: ODA = official development assistance, OOF = other official flows; USD = United States dollars.

[a] Parties should fill in a separate table for each year, namely 2015 and 2016, where 2018 is the reporting year.

[b] Parties should report, to the extent possible, on details contained in this table.

[c] Parties should explain, in their biennial reports, the methodologies used to specify the funds as disbursed and committed. Parties will provide the information for as many status categories as appropriate in the following order of priority: disbursed and committed.

[d] Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under "Other".

[e] Parties should report, as appropriate, on project details and the implementing agency.

[f] Parties should explain in their biennial reports how they define funds as being climate-specific.

[g] Please specify.

[h] This refers to funding for activities that are cross-cutting across mitigation and adaptation.

CTF Table 8: Provision of technology development and transfer support

No information provided in Table 8.

CTF Table 9: Provision of capacity-building support

Table 9 LVA_BR4_v0.1

Provision of capacity-building support[a]

Recipient country/region	*Targeted area*	*Programme or project title*	*Description of programme or project* [b,c]
Uzbekistan	Multiple Areas	"Support of the Latvian Clean Technology Cluster Cleantech Latvia for the Capacity Building of Regional Municipalities (hakimat) in Rural Areas of Uzbekistan"	The aim of the project was to promote sustainable growth in the regions. The training courses were based on the development needs of each specific region, but focused on 5 key topics - sustainable environmental planning, water management, municipal waste management and recycling, eco-friendly urban and regional environmental planning, bio-waste recycling for further use (including solutions for the recycling of agricultural and other biowaste using biogas and cogeneration)
Uzbekistan	Multiple Areas	"Capacity Building for Sustainable Development in Uzbekistan's Public Administration"	The project included training and consultations on energy efficiency, alternative energy and sustainable and safe agriculture for responsible officials and specialists involved in public administration in order to increase their capacity and raise awareness of the importance of sustainable development in improving the national economy.

[a] To be reported to the extent possible.

[b] Each Party included in Annex II to the Convention shall provide information, to the extent possible, on how it has provided capacity-building support that responds to the existing and emerging capacity-building needs identified by Parties not included in Annex I to the Convention in the areas of mitigation, adaptation and technology development and transfer.

[c] Additional information may be provided on, for example, the measure or activity and co-financing arrangements.