

**Report on the technical review
of the National Greenhouse Gas (GHG) Inventories
of the Republic of Moldova–
Energy Sector**

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I. Introduction and summary

1. This report covers the peer review of national GHG inventory – Energy Sector and of Chapter 3 ‘Energy Sector’ of the draft ‘National Inventory Report: 1990-2013, Greenhouse Gas Sources and Sinks in the Republic of Moldova’ before submission to the UNFCCC technical. The review was organized by the UNDP Moldova together with the Climate Change Office of the Ministry of Environment (MoEN) under the LECB Project – Republic of Moldova. The review took place from second to fifth of November, 2015 in Chisinau, Moldova and was conducted by the nominated experts from the UNFCCC roster of experts Ms. Veronika Ginzburg (Russian Federation).

2. The National inventory report of GHG sources and sinks in the Republic of Moldova in 1990-2013 is presented as a technical annex to the First Biennial Update Report (National Inventory Report: 1990-2013) of the Republic of Moldova under the UNFCCC. The national GHG inventory in the Energy sector is prepared according to the reporting requirements set up in Decision 17/CP.8 “Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention” and Decision 2/CP.17 Annex III “UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention”.

3. According to the above reporting requirements the Republic of Moldova as a country non-included in the Annex 1 to the Convention

- should use the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, for estimating and reporting their national GHG inventories, but also may use different methods,

- is encourage to use national methodology, country-specific and regional emission factors and activity data for key sources, provided that these methodologies are consistent, transparent and well documented,

- is encouraged, to estimate and report CO₂ fuel combustion emissions using both the sectoral and the reference approaches, and to explain any large differences between the two approaches,

- wishing to report on aggregated GHG emissions and removals expressed in CO₂ equivalents should use the global warming potentials (GWP) provided by the IPCC in its Second Assessment Report,

- is encouraged to provide information on methodologies used in the estimation of anthropogenic emissions of greenhouse gases, including a brief explanation of the sources of emission factors and activity data,

- is encouraged to identify areas where data may be further improved in future communications through capacity-building.

4. In 2013, the main greenhouse gas (GHG) in Moldova was carbon dioxide (CO₂), accounting for 64.9 per cent of total GHG emissions¹ expressed in CO₂ equivalent, followed by methane (CH₄) (21.0 per cent) and nitrous oxide (N₂O) (13.0 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) collectively accounted for 1.1 per cent of the overall GHG emissions in the country. The

¹ In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO₂ eq excluding LULUCF, unless otherwise specified.

energy sector accounted for 65.5 per cent of total GHG emissions, followed by the Agriculture sector (16.6 per cent), the Waste sector (12.2 per cent), the Industrial processes sector (5.2 per cent) and the SOPSU sector (0.5 per cent). Total GHG emissions amounted to 12 836.32 Gg CO₂ eq and decreased by 70.4 per cent between the base year and 2013. The description in the NIR of the trends for the different gases and sectors is reasonable.

5. National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors (in form of Table 1 as required by the Decision 2/CP.17, annex III, paragraph 9) is provided as Annex 1 to the Biennial Update Report (BUR 2015).

B. Energy

1. Sector overview

6. The energy sector is the main sector in the GHG inventory of the Republic of Moldova. In 2013, emissions from the energy sector amounted to 8404.62 Gg CO₂ eq., or 65.5 per cent of total GHG emissions. Since 1990, emissions have decreased by 75.65 per cent. The main key driver for the fall in emissions is economic decline in the Republic of Moldova, mainly within 1990-2000 periods. Within the sector, 39.4 per cent of the emissions were from energy industries, followed by 24.4 per cent from other sectors, 22.3 per cent from transport and 7.3 per cent from manufacturing industries and construction. Fugitive emissions from oil and gas system accounted for 6.2 per cent and non-specified emission category accounted for 0.4 per cent.

7. The Republic of Moldova uses the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories and apply tier 1 methodology for estimating and reporting GHG emissions in energy sector. Country specific parameters, such as net calorific values (NCVs) and default parameters from the IPCC 2006 Guidelines for National Greenhouse Gas Inventories are also used where they are available. Some emission categories, such as international aviation, are calculated using tier 2 methodology. In the next inventory cycle in 2016 preparing the GHG inventory for 1990-2014 Moldova has intention to use the IPCC 2006 Guidelines for National Greenhouse Gas Inventories as a basic methodology.

8. Whereas Moldova has no obligation to submit national GHGs inventory using the UNFCCC common reporting format, the IPCC 1996 software is used for calculating and presenting the inventory. The IPCC 1996 software worksheets do not correspond to the structure of categories identified in the IPCC 2006 Guidelines, they are developed separately for each year and do not allow to analyze time series and do not applicable for higher tiers methodology. In the case if Moldova apply IPCC 2006 Guidelines for National Greenhouse Gas Inventories as a basic methodology it is more appropriate to use the IPCC 2006 software for developing and presenting the inventory in energy sector.

9. The GHG inventory in energy sector is almost complete in terms of categories apart from some sources which are considered as insignificant (for example, autoproducers, waste and biomass incineration for energy purposes). In terms of gases the inventory is also complete and includes all GHGs - CO₂, CH₄ and N₂O and precursors – CO, NMVOCs, NO_x, SO₂. However, non-CO₂ gases emission is missed for pipeline transport (due to the structure of the IPCC 1996 worksheets). The inventory in energy sector is not fully complete in terms of fuels because not all fuels which are reported in the fuel and energy balance and other information sources (for example, bitumen) are considered in the inventory. The inventory is also not complete in terms of geographical coverage because only fragmentary activity data are available for Left Bank of the Dniester River (LBDR) after 1991.

10. The Party is encouraged to calculate missed gases emissions for pipeline transport, to evaluate the level of significance for categories which are not included in the inventory ensuring that emission from each of them is less than 0.05% of the total national GHG emission without LULUCF, and that all together they are not exceed of 0.1% of the total national GHG emission without LULUCF. The Party is also encouraged to check fuel completeness and continue efforts to collect data for LBDR or use indirect evaluations and statistical analysis to recover AD time series and completeness for the whole territory. It is also encouraged to use reference approach calculations for verification that all apparent consumption of fuel is accounted in the inventory.

11. National inventory report 1990-2013 (NIR 2015) is presented by the Republic of Moldova as a technical annex to the first BUR. NIR is prepared in accordance with the required structure includes summary of methods and reference of data sources. Emission factors (EFs) and other parameters used for the inventory are presented and references to data source are given. Emissions time series are presented in the NIR and reasonable explained. However, AD time series and time-series consistency not always transparently explained, particularly for LBDR territory. Sometimes NIR presents detail background information which is not used for calculation, this is confused. As a potential improvement of the NIR transparency the Party is encouraged to provide more detailed information about AD time-series and CS parameters calculation and exclude some additional background information which is not used for the inventory.

12. Activity data for energy sector emission estimation are mainly fuel consumption amounts. A national feature of Moldova is that statistical information is separated for the Right Bank of the Dniester River (RBDR) and the Left Bank of the Dniester River (LBDR). The efforts of the national inventory team for collection AD from both territories are much appreciated.

13. Energy statistics for RBDR is quite detailed. AD are available mostly from fuel and energy balance (FEB), as a response to official requests and from open sources. FEBs for Moldova are available in two formats since 2005 – in officially printed format with structure changing from year to year and in electronic format with stable structure for all years. For the inventory purposes data are mixed from the both FEB formats which are not always equivalent to each other (different categories, units, values). Thus, the activity data are inconsistency both among sources categories and time series. AD in energy balance are given in rounded values. As far as AD values in physical units in some cases (for example, for national navigation) are very small, when presented in rounded values they are equal to zero.

14. As a potential improvement of AD consistency it is suggested to choose one source of information as a priority and make efforts to incorporate other sources into the priority one. It is important to check fuel's mass balances. It is better to use AD values in TJ where it is possible. For other years and/or categories where AD in TJ are not available CS (for some fuels as coal - year specific) NCVs (for example, calculated from energy balance or other approved) should be used.

15. AD for LBDR are available from statistic yearbook, reference book on social-economic activities, as responses to requests, and from open sources. AD are not complete and not consistency across the time-series. As a potential improvement indirect activity data can be used to calculate fuel consumption, also statistical methods (regression analysis) to restore time series can be used in line with the Good Practice Guideline 2000 and 2006 IPCC Guidelines, ch. 5. The particular this issue is discussed in para 10, 21, 28, 31, 33-35, 38, 39, 45, 46.

16. During the in-country review it was identified that there are both double-counting and underestimations in use of AD comparing with data from energy and fuel balances;

misallocation of AD between categories (for example, transport and commercial/institutional). It is also noted that cross sectoral AD are not considered, for example, incineration of waste (from waste sector), and non-energy products use (with IPPU sector). Reference approach is calculated not in line with the IPCC Guidelines thus it cannot be reviewed and used as verification instrument.

17. Moldova is encouraged to cross check AD to avoid double counting and underestimations; calculate Reference approach according to the IPCC guidelines; check the allocation of AD between categories; check fuel mass balance and check cross-sectoral issues.

2. Reference and sectoral approaches

Comparison of the reference approach with the sectoral approach and international statistics

18. Difference between the reference approach and the sectoral approach in energy consumption is - 1787 TJ (-1.5 %), and in CO₂ emissions is 127.68 Gg CO₂ eq. (-1.7 %). Fuel consumption and CO₂ emissions for all fuels except of liquid fuels are equal in reference and sectoral approaches. The methodology, activity data and calculation parameters used for reference approach are not explained in the NIR as well as differences between the reference approach and the sectoral approach. Non-energy use of fuels is not appropriately considered.

19. During the in-country review it was identified that the reference approach is implemented not in line with the IPCC Guidelines. High convergence of reference and sectoral approach is caused by the methodology used by the Party when apparent consumption is not calculated but assumed to be equal to fuel consumption in sectoral approach. The difference in consumption of liquid fuel is caused by incorrect consideration of bunker fuel in reference approach.

20. The difficulty to implement reference approach in Moldova inventory is caused by the fact that fuel and energy balance (including production, import, export, and stock change) is available only for the RBDR territory, while for the LBDR territory only fragmental data on final consumption are existed.

21. Moldova is encouraged to implement reference approach estimations in line with the IPCC guidelines in order to verify the completeness, accuracy and consistency of sectoral approach and ensure that all potential emission sources are appropriately considered. Moldova is encouraged to make efforts receiving AD on export, import and stock change of fuels in the LBDR. In case if it is not possible, apparent consumption for the RBDR can be estimated separately while AD on fuel consumption in the LBDR can be added to the apparent consumption in the RBDR.

International bunker fuels

22. International navigation is not occurring in the Republic of Moldova. Aviation bunker fuel is reported by the Party assuming that all jet kerosene fuel is used for international aviation. Civil aviation is very small in Moldova and presented mainly by small aircrafts and helicopters which consume aviation gasoline. The fuel consumption for international aviation is reported based on the information provided by the Civil Aviation Administration (CAA) of the RM. These data are quite similar to those allocated to aviation in the EFB for 1990, 1993 - 2002, but it is almost twice higher for 2003-2012 and 3 times higher for 2013. According to the International Energy Agency (IEA) jet kerosene used for aviation bunker in Moldova in 2013 is equal to 21 kt, while national FEB gives 13 kt and CAA provide data on 41 kt. Taking into account that all apparent consumption of jet

kerosene is considered to be bunkering fuel it means that AD used to estimate GHGs emissions from international aviation are much higher than total amount of jet kerosene available in the country. This inconsistency should be further investigated by the Party.

23. The Party is encourage to ensure that amount of fuel used for international aviation provided by CAA of the RM corresponds to the amount of jet kerosene sold in the country for international aviation as it is required by the Revised 1996 IPCC Guidelines (p.1-22, step 1). It is also encourage cross checking activity data on jet kerosene used with national custom service, tax administration, statistical authority and CAA. Activity data could also be checked with productivity indicators such as fuel per unit of traffic performance (per passenger km or ton km). The revised amount of bunkered jet kerosene should be accounted both as import (for reference approach) and as international aviation fuel for reference and sectoral approaches.

24. Emission from international aviation is estimated using tier 2 methodology based on the detailed AD about LTO cycles by aircrafts provided by the CAA of the RM. A combination of methodologies from the Revised 1996 IPCC guideline and the IPCC 2006 Guidelines are applied. This cause some confusion, for example, according to the IPCC 2006 Guidelines N₂O emissions at cruise level can be computed indirectly from NO_x emissions while according to the Revised 1996 IPCC Guidelines N₂O emissions are calculated directly using the default EF. In the national inventory of Moldova both these approaches are mixed – NO_x emissions at cruise level are calculated using the default IPCC 2006 EFs while N₂O emissions are calculated using the default EFs from the Revised 1996 IPCC Guidelines. In additional EFs presented in the Table 3-124 of the NIR not always correspond to those used in the inventory worksheets (for example, NO_x EFs for cruise activity for A320 and for Fokker-100).

25. During the in-country peer review is was also explained by the Party that if aircraft types used in the country have no default EFs, average EFs were used calculated based on division of aircrafts by the country of production. This approach is also not in line with the IPCC guidelines which state that where aircraft types used in a country are not displayed, data for the nearest equivalent type can be used or alternatively the average emission factors displayed in Table 1-52 (The Revised 1996 IPCC Guidelines, Reference manual). The IPCC 2006 Guidelines provides correspondence between representative aircrafts and other aircraft types (volume 2, chapter 3, table 3.6.3).

26. As a potential improvement the Party is encouraged to choose one methodology as a priority one and fully implement it for estimation of emissions from international aviation. It is also encouraged cross checking EFs between the NIR and inventory worksheets; and evaluating average EFs for aircraft types not displayed in the IPCC Guidelines according to the methodology requirements.

Feedstocks and non-energy use of fuels

27. Non-energy use of fuels is not appropriately considered. The Party is encouraged to consider non-energy use of fuels in line with the IPCC guidelines in the next inventory cycle. The methodology used for feedstock and non-energy use of fuels is different in the Revised 1996 IPCC Guideline and the IPCC 2006 Guideline, so it should be carefully applied depending of which methodology will be chosen for the inventory.

3. Key categories

Stationary combustion: gaseous fuel – CO₂

28. CO₂ emissions from the stationary combustion of natural gas are calculated using default CO₂ emission factors (EFs) from the IPCC 2006 Guidelines and country specific NCV. Activity data are available from the Energy Balances of the Republic of Moldova for

1990, 1993-2013 and also provided by the “Moldovagaz” J.S.C. AD for public electricity and heat production are also provided directly from Moldovan Thermal Power Plant (MTPP) for the LBDR. Natural gas AD are generally consistent for all time series, apart from manufacturing industries and construction where data are available only for 1990, 1995-2013. CO₂ emissions are estimated in line with the IPCC Guidelines however, as far as stationary combustion of natural gas (particularly by energy industries) is key category, tier 2 methodology should be applied for CO₂ emissions calculation. Moldova is encouraged to start investigations to develop country specific CO₂ EF for natural gas, alternatively CS carbon content can be the same as in the exporting countries. It is also desirable that Moldova try to use indirect activities data and regression analysis to restore time series of AD on natural gas for LBDR.

Stationary combustion: liquid fuel, solid fuel – CO₂

29. CO₂ emissions from the stationary combustion of liquid and solid fuels are calculated using default CO₂ emission factors (EFs) from the IPCC 2006 Guidelines and country specific NCV. The main source of activity data is the Energy Balances of the Republic of Moldova annually published by the National Bureau of Statistics (NBS), for 1990, 1993-2013 years and Statistical Yearbooks, including those of the activity data regarding fuel consumption on the territory on the left bank of the Dniester River.

30. Country specific NCVs are provided by the Instruction for Compiling the Statistical Report nr.1-EB “Energy Balance”, approved through Order No. 88 from 03.10.2012 of the Department of Statistics of the RM. However, NCV for coal is not constant and depends of the mining basin, thus, the average value is not approved by this Instruction. Some assumptions made in the NIR about CS NCVs of anthracite and other bituminous coal are not proved. Energy balances are calculated based on different NCVs which are higher than those used in the inventory. This can result in underestimation of emissions. In the next inventory submission Moldova is encouraged to evaluate country specific coal NCV for each year based on custom information about imported coal origination or using NCV calculated each year for energy and fuel balance the statistical department. If it is not possible, the IPCC default NCVs for solid fuels can be used.

31. In energy industries category which is presented in Moldova only by sub-category public energy and heat production AD for coal, residual fuel oil AD are available only since 2008 for LBDR, diesel/gas oil AD exist only for RBDR. During the in-country review it was also identified that other kerosene use is missed in the inventory worksheets while it exists in the energy balance for 1990. For the further improvement of the inventory Moldova is encouraged to check activity data accuracy and fill the missed values. It is also desirable that Moldova try to use indirect activities data and regression analysis to restore AD coal, residual fuel oil, diesel oil for LBDR

32. Emissions from manufacturing industries and construction are aggregated in one category and reported not in line with the IPCC reporting structure. A number of inaccuracies were identified during the in-country review such as AD for bitumen were not considered in calculation in 2013 while they exist in the FEB; coke is considered as coal in the inventory worksheets for the year 1990 and as a result lower NCV and EF are applied; double counting of a part of gas/diesel oil exists in 1990. For the further improvement of the inventory Moldova is encouraged to correct activity data mistakes and misallocation; to disaggregate data for sub-categories in line with the IPCC reporting structure or at least to identify three sub-categories: food industry, non-metallic industry and other industries.

33. During the review week the Party explained that fuels combusted for energy purposes at stationary sources belonged to transport enterprises are allocated to commercial and communal consumption in the latest structure of energy balance since 2005. Accordingly, emissions from these sources are properly accounted in

commercial/institutional category in the inventory for 2005-2013. However, for the previous years such disaggregation of data was not applied in the EFB of the RM and this activity is missed in the inventory (AD are not accounted neither in commercial/institutional category nor in transport category). Only AD on liquid and solid fuel used for commercial/institutional purposes in the LBDR territory are not available. For the further improvement of the inventory Moldova is encourage to check reallocation of AD from transport sector to commercial/institutional for all time series. It is also desirable that Moldova try to use indirect activities data and regression analysis to restore AD for fuels other than natural gas for LBDR.

34. AD on motor fuels (gasoline, diesel) sold in residential sector are accounted in road transport, but, LPG is accounted in residential sector. For the further improvement of the inventory in residential sector Moldova is encourage reviewing whether LPG can also be used for road transport and, if so, considers possibility to move a part of LPG sold to residents to road transport. AD on residential use of solid and liquid fuels for the LBDR territory are not available. Moldova is encouraged to try using indirect activities data and to restore AD for residential sector in LBDR.

35. In agriculture/ forestry/ fishing category AD for LBDR for mobile combustion are available (diesel oil, gasoline, lubricants) but not for the entire time series. As it is explained in the NIR 10% from gasoline and diesel oil use in agriculture is moved to road transport because it is assumed that these fuels are used by road transport. This looks quite reasonable, but the NIR does not provide transparent justification of this assumption. During the in-country review week some data entry mistakes were identified, such as constant amount of residual fuel oil and coal use since 2008; allocation of total coal amount to anthracite in 2013 which has different NCV and EF. In order to further improve the inventory Moldova is encouraged to check AD for coal and residual fuel oil since 2008; correct allocation of AD for coal in 2013. It is also desirable try to use indirect activities data to estimate fuel consumption by stationary sources in agriculture/ forestry/ fishing and regression analysis to restore AD for mobile sources in LBDR for all time series.

Fugitive emissions: Oil and gas system – CH₄

36. Fugitive emissions from oil and gas system are estimated based on the IPCC 2006 Guidelines using default EFs. Oil exploration in Moldova is relatively small; it was reactivated in 2003 after long conservation since 1964. Five old oil wells were reopened and 5 new wells were drilled. AD on oil production are available from Energy balance of the RM and from open publications. Accounting fugitive emissions from well drilling, testing, servicing the Party uses AD on number of drills as it was requested in the Revised 1996 IPCC Guidelines, but EFs are applied from the IPCC 2006 Guidelines which assume using of AD on oil production and are provided in Gg/10³ m³ of oil production. Thus, the estimated emissions from well drilling, testing, servicing cannot be considered as representative and should be recalculated using one methodology either the Revised 1996 IPCC guideline or the IPCC 2006 Guidelines. As far as Moldova is not an Annex I party it has no obligation to use the IPCC 2006 Guidelines, then methodology based on the number of drills (the Revised 1996 IPCC guideline, Good Practice Guidelines 2000) can be applied. In this case it is also encouraged to provide more transparent information in the NIR on number of wells disaggregated by oil and gas exploration including the year of drilling, testing and service.

37. Gas production starts in the Republic of Moldova in the year 2003. AD on gas distribution provided by “Moldovagaz” has a good correspondence with apparent consumption of natural gas calculated from energy balance. During the in-country review Moldova explained that there are measurement data provided by “Moldovagaz” on venting emissions from natural gas transport system. As far as this is a key category the use of tier 3 (measurement data) is much appreciated, but time series availability and measurement

representativeness should be very carefully examine, including comparison of the measured fugitive emissions with NG loses from the energy balance. Also all transparent information on the methodology, AD and measurement conditions should be included in the NIR.

Mobile combustion: Road transport – CO₂

38. Emissions of CO₂ from road transport are evaluated based on the IPCC tier 1 methodology and default emission factors using AD from energy balance on NG and LPG consumption and AD for gasoline and diesel oil combined from road transport, residence use and 10% from agriculture use. AD for LBDR are only available for diesel oil from agriculture sector. As a potential improvement of time series consistency and inventory completeness Moldova is encouraged trying to use indirect activities data and regression analysis to restore AD for LBDR.

Mobile combustion: Railways – CO₂

39. Emissions of CO₂ from railway transport is a key category by trend analysis, it is estimated using tier 1 method, default IPCC EFs and CS NCVs. AD are provided by “Moldavian Railways” since 1990 and also available from the energy balance. The NIR presents data on length and density of railways both in RBDR and LBDR, however geographical coverage of AD on gas/diesel oil for different years is not clear from the NIR and also it was not clarified during the review. Mass balance of diesel fuel does not converge because apparent consumption in energy balance is less than total consumption in the inventory. As a potential improvement it is encouraged to ensure that AD of fuel consumption include only mobile combustion by railway transport and do not include stationary combustion of gas/diesel oil with energy purposes or mobile combustion by road transport belonged to railway company. Other fuels allocated under railway sector in energy balances (1990, 1993-1997) should be considered under commercial/ industrial category. It is also encouraged to clarify the geographical coverage of AD and try to use regression analysis and indirect activities to restore time series for LBDR.

4. Non-key categories

Stationary combustion - Non-specified: liquid, solid, gaseous fuels - all gases

40. AD for evaluation emissions from non-specified fuel combustion consist of fuels allocated in the energy balance for other purposes; military fuel provided by the Military service of the RM and lubricants used for non-energy purposes. As it was identified during the review week there are some inaccuracies in data consideration for this category, such as follows: not all fuels from energy balance are accounted in the inventory as well as not all military fuel provided by the military authority is accounted. Moldova is encouraged to check correctness of AD. Non-CO₂ emissions from military are estimating using default EFs for stationary combustion but AD are related to military aviation and off-road transport. This is not in line with the IPCC Guidelines. Moldova is encouraged to calculate CH₄ and N₂O emissions from military fuel in accordance with the methodology developed for military aviation (IPCC, 2006 chapter 3.6.1.4) and off-road transport (IPCC, 2006 chapter 3.3).

41. CO₂ emissions associated with the emissive part of the non-energy use of lubricants are included in non-specified category. Calculations are made according to the Revised 1996 IPCC Guidelines tier 1. Default emission factor is used for estimation of carbon contents in lubricants but carbon stored fraction is not applied while the default value for carbon storage on not-energy use of lubricants is 0.5. For further improvement of the inventory it is encouraged to use carbon stored factor when calculating emissions from lubricants NEU in according to the Revised 1996 IPCC Guidelines. However, it should be noted that if the Party decided to use the IPCC 2006 Guidelines emissions from lubricant's

use should be accounted in IPPU sector while only emissions from lubricants combustion should be still accounted in the energy sector.

Stationary combustion: biomass – CO₂, CH₄, N₂O

42. During the in-country review the Party explained that during the last years there is significant increase in biomass used as a fuel in Moldova especially in residence sector however it is very difficult to evaluate exact amount of biomass used. AD of biomass were recalculated by the Statistical authority by new methodology and provided in TJ for the 2010-2013. The rest of time series (1990-2009) is collected by different methodology and provided in in natural units. This results in inconsistency of time series and causes some inaccuracy in transferring to TJ in the inventory worksheets. For example, NCVs used for wood are different for 1990-2009 and 2010-2013; NCVs for other solid biomass and charcoal are also different for 1990-2009 and 2010-2013. In additional, AD and EFs for different types of biomass are aggregated while default emission factors are rather different (ex., charcoal EF CO₂ IPCC default “30.5” and Other biomass (used in the inventory) – “27.3”). Moldova is encouraged to calculate time series of NCVs for biomass, use AD in TJ where it is available and CS biomass type specific and year specific NCVs for the rest of time series. CS NCVs should be proved and explained in the NIR. It is also encouraged to use disaggregated AD and EFs by biomass type from the IPCC 2006 Guidelines (volume 2, table 2.2-2.5). As far as AD on biomass use are currently available only for the RBDR, it is encouraged trying to use indirect activities data and regression analysis to restore AD for LBDR.

Agriculture/ Forestry/ Fishing: liquid fuel – CH₄, N₂O

43. Non-CO₂ emissions from mobile sources in agriculture/ forestry/ fishing are calculated using EFs for appropriate for stationary combustion. This is not in line with the IPCC guidelines. In order to further improve the inventory it is encouraged to calculate emissions from mobile sources in agriculture using methodology and CH₄, N₂O EFs provided in the IPCC Guidelines for off-road transport.

Road transport: liquid fuel, gaseous fuel – CH₄, N₂O

44. Non-CO₂ gases emissions from road transport are calculated using the IPCC default EFs. During the in-country review it was presented that AD for applying tier 3 methodology for non-CO₂ gases emissions estimations from road transport are available. However, as far as CH₄ and N₂O emissions from road transport are not key categories and at the same time the use of tier 3 do not results in improvement of CO₂ emissions evaluation, as a first step for the potential improvement Moldova is encouraged to calculate time series of CS EFs for CH₄ and N₂O using the rate of road vehicles by different Euro class. It is also encouraged to use default EF for CH₄ and N₂O for LPG separately from gasoline. In case if after all these improvements, CH₄ and N₂O emissions from road transport became key category it is encouraged to apply the IPCC 2006 tier 3 methodology using the available AD on road vehicles structure.

Mobile combustion: liquid fuel, gaseous fuel – all gases

45. Civil aviation is presented in Moldova by small aircrafts and helicopters which use aviation gasoline. Emissions from aviation gasoline consumption are estimated in the inventory since 2001 using tier 1 method and default EFs. During the in-country review it was identified that AD on aviation gasoline are available for 1990, and since 1993 in energy balances. The NIR (table 3-39) presents information about number of aircrafts operated since 1996. It was explained by the Party that energy balance for 1990 includes information about aviation gasoline used for all territory of Moldova, while the later data present information about fuel used for civil aviation only in RBDR. This cause

underestimation of civil aviation emissions before 2001 and inconsistency of time series. As a potential improvement it is encouraged to consider AD for aviation gasoline for all years when they are available in the energy balance for the RBDR and restore AD and emissions time series for LBDR using AD for 1990 from energy balance and regression analysis.

46. AD on navigation are presented in rounded figures in the energy balance. Thus as fuel used for navigation is quite low it is often indicated as “zero” in physical units while in “TJ” it has some meaningful amount. Currently, AD on gas/diesel oil for navigation are considered according to information provided by the Ministry of Transport and Road infrastructure of the RM only for the RBDR for 1993-2013 and by the energy balance for all territory in 1990. These data are not consistent with the figures from energy balances provided in TJs. As a potential improvement it is encouraged to consider AD for navigation for all years when they are available in the energy balance in TJs for the RBDR and restore AD and emissions time series for LBDR using AD for 1990 from energy balance and regression analysis.

II. Conclusions and recommendations

Conclusions

47. Table 6 summarizes the conclusions on the inventory in energy sector of the Republic of Moldova, in accordance with the guidelines for review under Article 8 of the Kyoto Protocol.

48. It is concluded that the inventory of Moldova in part of energy sector is almost complete in terms of categories, gases and years but not complete by geographical boundaries. The NIR is presented as a technical annex to the first BUR and inventory is presented in excel worksheets using the 1996 IPCC Software.

49. It is concluded that the inventory for energy sector has been prepared and reported in accordance with UNFCCC reporting guidelines for non-annex I Parties set in Decision 17/CP.8 “Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention” and Decision 2/CP.17 Annex III “UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention”.

50. The Party’s inventory is in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the *IPCC 2006 Guidelines for National Greenhouse Gas Inventories*.

Potential improvements

51. The issues were identified for improvement listed in table.

| <i>Sector</i> | <i>Category</i> | <i>Encouragements</i> | <i>Paragraph reference</i> |
|---------------|--|--|--|
| Cross-cutting | Completeness | Continue efforts to collect data for LBDR or use indirect evaluations and statistical analysis to recover AD time series | 10, 15, 21, 28, 31, 33, 34, 35, 38, 39, 45, 46 |
| | | Evaluate the level of significance for categories which are not included in the inventory | 10 |
| | | Check fuel completeness | 10 |
| | Transparency | Provide more detailed information about AD time-series and CS parameters calculation and exclude some additional background information which is not used for the inventory | 11 |
| | Accuracy | Choose one source of information as a priority and make efforts to incorporate other sources into the priority one. It is important to check fuel's mass balances. It is better to use AD values in TJ | 14 |
| | QA/QC | to cross check AD to avoid double counting, underestimations and printing mistakes | |
| Energy | Reference approach | Calculate Reference approach Reference approach according to the IPCC guidelines | 17, 21 |
| | International aviation | Cross checking activity data on jet kerosene use | 23 |
| | | Choose one methodology as a priority and check accuracy of EFs | 26 |
| | Non-energy use of fuels | Consider non-energy use of fuels in line with the IPCC guidelines | 27 |
| | Stationary combustion – natural gas | Develop country specific CO ₂ EF for natural gas | 28 |
| | Stationary combustion – solid fuel | Evaluate country specific coal NCV for each year | 30 |
| | Stationary combustion – liquid fuel | To check activity data accuracy and fill the missed values | 31 |
| | Manufacturing industries and construction | Disaggregate data for food industry, non-metallic industry and other industries; correct activity data mistakes | 32 |
| | Commercial/ Institutional | Check reallocation of AD from transport sector to commercial/institutional | 33 |
| | Residential | Move a part of LPG sold to residents to road transport. | 34 |
| | Fugitive emissions – well drilling, testing, servicing | Recalculated using one methodology either the Revised 1996 IPCC guideline (AD and EF on drills number) or the IPCC 2006 Guidelines (AD and EF on oil production). | 36 |
| | | Provide more transparent information in the NIR on number of wells | 36 |
| | Fugitive emissions – natural gas | Use of tier 3 (measurement data) for venting emissions from natural gas transport system | 37 |
| | | Provide transparent information on the methodology, AD and measurement conditions | 37 |
| | Railways – liquid fuel | Ensure that AD of fuel consumption include only mobile combustion by railway transport | 39 |
| | Stationary combustion: not specified | Check accuracy of AD | 40 |

| <i>Sector</i> | <i>Category</i> | <i>Encouragements</i> | <i>Paragraph reference</i> |
|---------------|--------------------------------|--|----------------------------|
| | | Calculate CH ₄ and N ₂ O emissions from military fuel in accordance with the methodology developed for military aviation and off-road transport | 40 |
| | | Use carbon stored factor when calculating emissions from lubricants NEU in according to the Revised 1996 IPCC Guidelines, or alternatively use the IPCC 2006 methodology | 41 |
| | Agriculture/ forestry/ fishing | Check AD for coal and residual fuel oil since 2008 | 35 |
| | | Calculate emissions from mobile sources in agriculture using methodology and CH ₄ , N ₂ O EFs provided in the IPCC Guidelines for off-road transport | 43 |
| | Road transport | Calculate time series of CS EFs for CH ₄ and N ₂ O using the rate of road vehicles by different Euro class | 44 |
| | Civil aviation | Consider AD for aviation gasoline for all years when they are available in the energy balance | 45 |
| | National navigation | Consider AD for navigation for all years when they are available in the energy balance in TJs | 46 |

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Decision 17/CP.8 “Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention”

Decision 2/CP.17 Annex III “UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention”

“Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention”. FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Marius Taranu (Climate Change Office, Ministry of Environment) and Ms. Elena Bicova (Institute of Power Engineering of the Academy of Sciences of the Republic of Moldova), including additional material on the methodology and assumptions used.

The following documents were also provided by Party:

- The Instruction for Compiling the Statistical Report nr.1-EB “Energy Balance”, approved through Order No. 88 from 03.10.2012 of the Department of Statistics of the RM
- National inventory report of the Republic of Moldova for 1990-2013, including chapter 3 – Energy sector
- GHG inventory software worksheets for 1990-2013
- Energy and fuel balances of Moldova for 1990-2013
- Информационный-статистический бюллетень январь-ноябрь 2013 г, Государственная служба статистики Приднестровской Молдавской Республики.

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- Социально-экономическое развитие Приднестровской Молдавской Республики за 2014 г. Государственная служба статистики Приднестровской Молдавской Республики.
 - Статистический ежегодник 2015 Приднестровской Молдавской Республики за. Государственная служба статистики Приднестровской Молдавской Республики.
 - Основные показатели работы промышленности республики за 2013 г. (без субъектов малого предпринимательства). Государственная служба статистики Приднестровской Молдавской Республики.
 - The Third National Communication of the Republic of Moldova under the United Nations Framework Convention on Climate Change. Chisinau, 2013
 - National Inventory Report: 1990-2010. Greenhouse Gas Sources and Sinks in the Republic of Moldova. Chisinau, 2013
 - Presentations of national experts and authorities during the first mission November 2-5, 2015. Chisinau, Moldova.

Annex II

Acronyms and abbreviations –

| | |
|--------------------|--|
| AD | activity data |
| BUR | Biennial Update Report |
| CH ₄ | methane |
| CO ₂ | carbon dioxide |
| CO ₂ eq | carbon dioxide equivalent |
| CAA | Civil Aviation Administration |
| CS | country specific |
| EF | emission factor |
| FEB | fuel and energy balance |
| Gg | gigagramm (1 Gg = 10 ⁹ g) |
| GHG | greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ without GHG emissions and removals from LULUCF |
| GPG | good practice guidelines |
| GWP | global warming potential |
| HFCs | hydrofluorocarbons |
| IEA | International Energy Agency |
| IPCC | Intergovernmental Panel on Climate Change |
| IPPU | industrial production and products use |
| kg | kilogram (1 kg = 1,000 grams) |
| LBDR | Left Bank of the Dniester River |
| LECB | The UNDP Low Emission Capacity Building Global Programme |
| LTO | landing/take off cycle |
| LULUCF | land use, land-use change and forestry |
| m ³ | cubic meters |
| MTPP | Moldovan Thermal Power Plant |
| N ₂ O | nitrous oxide |
| NCV | net calorific value |
| NIR | national inventory report |
| NMVOG | non-methane volatile organic compound |
| PFCs | perfluorocarbons |
| RBDR | Right Bank of the Dniester River |
| RM | Republic of Moldova |
| SOPU | solvent and other product use |
| QA/QC | quality assurance/quality control |
| SF ₆ | sulphur hexafluoride |
| SO ₂ | sulphur dioxide |
| TJ | terajoule (1 TJ = 10 ¹² joule) |
| UNFCCC | United Nations Framework Convention on Climate Change |