

TECHNICAL REVIEW OF THE NATIONAL GHG INVENTORY – ENERGY SECTOR

Main findings of the review, including
identified issues and potential problems

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Main issues reviewed

General:

- Adherence to the reporting requirements set up in Decision 17/CP.8 and Decision 2/CP.17
- Completeness
- Transparency
- Accuracy
- Energy statistics

By categories:

- Choice of methodology
- Activity data
- Emission factors
- Time series consistency

1. General issues

Reporting requirements for the GHG inventory (concerning Energy sector)

Republic of Moldova as a Non-Annex I Party

- Should use the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, for estimating and reporting their national GHG inventories
- May use different tiers methods,
- 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
- 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

Reporting requirements for the GHG inventory (concerning Energy sector) – 17/CP.8

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

Guidelines and soft used by the Party

- - The Revised IPCC 1996 Guidelines
- - 2006 IPCC Guidelines
- - GPG 2000
- - IPCC 1996 soft worksheets
- - GWP from the IPCC in its Second Assessment Report

Identified issues:

- Soft worksheets not correspond to the structure of categories identified in the Guidelines
- There is no time trends analysis
- Not applicable for higher Tiers methodology and for 2006 IPCC Guidelines

Suggestion

- Investigate possibility to use IPCC 2006 Inventory software
- Discuss the eligibility of GWP from the IPCC in its Fourth Assessment Report

Completeness

Total Energy	Category	CO ₂	CH ₄	N ₂ O	NO _x	CO	NM VOC	SO ₂
A Fuel Combustion Activities (Sectoral Approach)								
1 Energy Industries								
a Public Electricity and Heat Production	X	X	X	X	X	X	X	X
b Petroleum Refining	NO	NO	NO	NO	NO	NO	NO	NO
c Manufacture of Solid Fuels and Other Energy Industries	NA	NA	NA	NA	NA	NA	NA	NA
2 Manufacturing Industries and Construction								
a Iron and Steel	IE	IE	IE	IE	IE	IE	IE	IE
b Non-Ferrous Metals	NO	NO	NO	NO	NO	NO	NO	NO
c Chemicals	IE	IE	IE	IE	IE	IE	IE	IE
d Pulp, Paper and Print	IE	IE	IE	IE	IE	IE	IE	IE
e Food Processing, Beverages and Tobacco	IE	IE	IE	IE	IE	IE	IE	IE
f Other (please specify)	IE	IE	IE	IE	IE	IE	IE	IE
3 Transport								
a Civil Aviation	X	X	X	X	X	X	X	IE
b Road Transportation	X	X	X	X	X	X	X	IE
c Railways	X	X	X	X	X	X	X	IE
d Navigation	X	X	X	X	X	X	X	IE
e Other (please specify)								
Pipeline Transport	X	NE	NE	NE	NE	NE	NE	?
4 Other Sectors								
a Commercial/Institutional	X	X	X	X	X	X	X	IE
b Residential	X	X	X	X	X	X	X	IE
c Agriculture/Forestry/Fishing	X	X	X	X	X	X	X	IE
5 Other (please specify)	X	X	X	X	X	X	X	IE
B Fugitive Emissions from Fuels								
1 Solid Fuels								
a Coal Mining	NO	NO	NO	NO	NO	NO	NO	NO
b Solid Fuel Transformation	NO	NO	NO	NO	NO	NO	NO	NO
c Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO
2 Oil and Natural Gas								
a Oil	X	X	X	X	NA	NA	X	NA
b Natural Gas	X	X	X	X	NA	NA	X	NA
c Venting and Flaring	X	X	X	X	NA	NA	X	NA
Memo Items (1)								
International Bunkers								
Aviation	X	X	X	X	X	X	X	X
Marine	NA	NA	NA	NA	NA	NA	NA	NA
CO₂ Emissions from Biomass	X							

Completeness

- - categories – almost complete
(some categories are considered insignificant – autoproducers, waste and biomass incineration for energy purposes)
- - gases – almost complete
(Non-CO2 gases from pipeline transport)
- - fuel – not complete
(some fuels from Energy balances are not accounted)
- - geographical territory – not complete
(fragmentary AD are available for Left Bank of the Dniester River)

Potential Improvements / Recommendations:

- Calculate missed gases
- Evaluate the level of insignificant categories (<0.05% each, <0.1% - together)
- Check fuel completeness
- Use Reference approach for verification of completeness
- Continue efforts to collect data for LBDR or use indirect evaluations and statistical analysis to recover AD time series and completeness

Transparency

- NIR is prepared in accordance with the required structure
- Includes summary of methods and reference of data sources
- AD time series and time-series consistency **not** always transparently explained
- Sometimes NIR present detail background information not used for calculation – **confused**
- EF – presented and reference of data are given
- CS parameters (NCVs) presented **but not proved**

Potential Improvements / Recommendations:

- Provide more transparent information about AD time-series and CS parameters calculation
- Exclude some additional background information which is not used for the inventory

Accuracy

- Method - Tier 1 (except of International aviation – Tier 2)
- For some **key categories** AD for higher tier are available (1B2b – gas transportation and distribution)
- For some **not key categories** AD for higher tier are available (road transport – CH₄, N₂O; Energy production – CH₄, N₂O)

Potential Improvements / Recommendations:

- Use tier 3 method for 1B2b - but be careful to check the representativeness of measurements, lower tier calculations, time-series consistency.
- Higher tiers for not key categories – not higher-priority. Calculate one year case study.

Accuracy

- AD – fuel consumption at national level
- Both double-counting and underestimations were identified in use of AD
- Misallocation of AD between categories (for example, transport and commercial)
- Reference approach is calculated not in line with the IPCC Guideline – can not be reviewed and used as verification instrument
- Cross sectoral AD
 - incineration of waste (from waste sector),
 - non-energy products use (with IPPU sector)

Potential Improvements / Recommendations:

- 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
- Check cross-sectoral issues

Accuracy

- EFs – default IPCC
- Some non-CO2 gases EFs are not appropriately selected (ex., mobile combustion if agriculture)
- Some EFs are applied for not appropriate AD (different units) – mistake in the published copy of the IPCC Guidelines

Potential Improvement / Recommendation:

- Cross-check EFs, apply the appropriate

Energy statistics

Right Bank of the Dniester River

- Energy balance, official letters, open sources
- Energy balance has two versions not always equivalent to each other (different categories, units, values)
- AD in Energy balance are given in rounded values

Potential Improvements / Recommendations:

- Choose one source of information as priority (energy balance)
- Try to incorporate other sources into the priority one
- Check fuel's mass balances
- Use AD in TJ where it is possible, for other years/categories use CS (for some fuels as coal - year specific) NCVs calculated from energy balance or other approved

Energy statistics

Left Bank of the Dniester River

- Statistic yearbook, Reference book on social-economic activities, answers to requests, open sources
- AD are not complete and not consistence across the time-series

Potential Improvements / Recommendations:

- Use indirect activity data to calculate fuel consumption
- Use statistical methods (regression analysis) to restore time series

2. Categories specific issues

Net calorific values

- CS NCVs are used for stationary combustion
- Some CS NCVs are less than the IPCC default
- Assumed that NCV for anthracite is equal to NCV of Donetsk coal, NCV for other bituminous coal is equal to Kuznetsk coal – **not proved**
- NCVs for coal use to change from year to year. Energy balance is calculated based on different NCVs which is higher than those used in the inventory – **underestimations**

Potential Improvements / Recommendations:

- - use AD in TJ where it is available,
- - use for other years/categories CS (for some fuels as coal - year specific) NCVs calculated from energy balance or other approved

Stationary combustion

1A1 - Energy industries

a – Public electricity and heat production

- AD from energy balance for RBDR, and from Moldovan Thermal Power Plant (MTPP)
- Other kerosene use is missed in 1990
- NG AD are consistence for all time series
- Coal, residual fuel oil – since 2008 for LBDR
- Diesel oil – only for RBDR

Potential Improvements / Recommendations:

- Check activity data (missed values)
- Try to use indirect activities data and regression analysis to restore AD coal, residual fuel oil, diesel oil for LBDR

Stationary combustion

1A2 – Manufacturing industries and construction

- AD from Energy balance
- No disaggregation by industry categories
- Bitumen AD not included in calculation - 2013
- Coke is calculated as coal – misallocation (different NCV, EF) -1990
- Double counting of diesel fuel (partly) – 1990
- Biomass – AD in tce, NCV – for natural tons
- Time series - NG AD for LBDR 1990, 1995-2013

Potential Improvements / Recommendations:

- Disaggregate data for food industry, non-metallic industry and other
- Correct activity data mistakes and misallocation
- Correct NCVs
- Try to use indirect activities data and regression analysis to restore AD for LBDR

Stationary combustion

1A4a – Other sectors – Commercial/Institutional

- AD from Energy balance
- AD for LBDR (only NG)
- EFs – default IPCC,
- NCVs – CS
- Stationary combustion in transport sector – last years Energy balances – right allocation (for previous years – AD are lost – not moved to commercial sector)

Potential Improvements / Recommendations:

- Check reallocation of AD from transport sector for all time series
- Check NCVs
- Try to use indirect activities data and regression analysis to restore AD for LBDR (other than NG)

Stationary combustion

1A4b – Other sectors - Residential

- Motor fuels (gasoline, diesel) – moved to Road transport
- Natural gas data are available for both RBDR and LBDR
- LPG – accounted in Residential sector (can also be used for road transport)
- EFs – default IPCC
- NCVs – CS

Potential Improvements / Recommendations:

- Generally is OK
- Check LPG use for road transport
- Check NCVs
- Try to use indirect activities data and regression analysis to restore AD for LBDR (other than NG)

Stationary combustion

1A4c – Other sectors - Agriculture

- AD for LBDR for mobile combustion are available (diesel oil, gasoline, lubricants) – **is not available for all years**
- 10% from gasoline and diesel oil use in Agriculture is moved to road transport
- Residual fuel oil and coal use from are constant from 2008
- Coal combustion is calculated as anthracite in 2013 – misallocation – different NCV and EF
- EFs – default IPCC
- NCVs – CS
- EF for non-CO2 gases from mobile sources – use as for stationary combustion

Potential Improvements / Recommendations:

- Check AD for coal and residual fuel oil since 2008
- Correct allocation of AD for coal in 2013
- Use EF CH₄, N₂O for off-road transport for mobile sources in agriculture
- Check NCVs
- Try to use indirect activities data and regression analysis to restore AD for LBDR **for all time series**

Stationary combustion

1A5 – Non-specified

- AD from energy balance
- Not all fuels from energy balance are accounted in the inventory
- Lubricants from all categories are accounted in the category 1A5
- Military fuel – for RBDR – not all provided AD are accounted

Potential Improvements / Recommendations:

- Check correctness of AD
- Use carbon stored factor when calculating emissions from lubricants NEU.
- If move to the IPCC 2006 – emissions from lubricants use should be accounted in IPPU sector (only emissions from lubricants combustion should be still accounted in the Energy sector)
- Use EFs for CH₄ and N₂O for military aviation the same as for domestic aviation
- Use EFs for CH₄ and N₂O for military road transport the same as for off-road transport

Stationary combustion

- **Biomass**
- AD – for the 2010-2013 – recalculated by the Statistical authority and provided in TJ
- The rest of time series (1990-2009) – in natural units.
- NIR (table 3-130) – present data in natural units (mistake)
- NCVs for wood are different for 1990-2009 and 2010-2013 – not consistence
- NCVs for other solid biomass and charcoal are also different for 1990-2009 and 2010-2013 – not consistence
- CS NCVs are less than IPCC default
- AD and EFs for different types of biomass are aggregated (ex., charcoal EF CO₂ IPCC default “30,5” and Other biomass (used in the inventory) – “27,3”)

Potential Improvements / Recommendations:

- 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
- Use disaggregated AD and EFs (IPCC 2006) by biomass type
- Try to use indirect activities data and regression analysis to restore AD for LBDR

Mobile combustion

Domestic aviation:

- AD on aviation gasoline
- Time series since 2000
- Energy balance provide data on Aviation gasoline for 1990, 1993 – not used in the inventory

Potential Improvements / Recommendations:

- Restore AD and emissions time series from 1990 using AD from energy balance and regression analysis

Mobile combustion

Road transport

- AD NG, LPG from Energy balance
- AD for gasoline and diesel oil = road transport+residence+10% from agriculture
- AD for LBDR only for diesel oil from agriculture
- EF – default IPCC

Potential Improvements / Recommendations:

- Calculate time series of CS EFs for CH₄ and N₂O using the rate of road vehicles by different Euro class
- Use default EF for CH₄ and N₂O for LPG (do not aggregate with gasoline)
- Try to use indirect activities data and regression analysis to restore AD for LBDR
- If after all these improvements, CH₄ and N₂O emissions from road transport became key category – try to use tier 3

Mobile combustion

Railways

- AD from railway company since 1990
- Not clear geographical coverage for different years
- Only diesel oil is used
- Mass balance of fuel does not converge (apparent consumption in energy balance is less than total consumption in the inventory) – probably some diesel fuel provided by the railway company is allocated under road transport consumption in energy balance

Potential Improvements / Recommendations:

- Check AD, check mass balance of diesel oil
- Ask railway company for clarifications
- Account other fuel allocated under railway sector in energy balances (1990, 1993-1997) under commercial category
- Try to use regression analysis and indirect activities to restore time series for LBDR

Mobile combustion

Navigation

- AD from official letters
- Only diesel oil
- Energy balance provide AD in TJ, but in natural units = 0
- Energy balance 1990 – has AD on Navigation

Potential Improvement / Recommendation:

- Use AD from energy balance in TJ

Mobile combustion

Pipeline transport

- Energy balance data for all years

Potential Improvement / Recommendation:

- Check whether all other fuels (except NG) are moved to commercial category

Fugitive emission

Oil and gas system

- AD from Energy balance and publications (open sources)
- EFs – IPCC 2006 Guidelines
- Well drilling, testing, servicing - AD – number of drills, EFs – kg/103 oil production – mistake in IPCC Guideline printing copy
- Oil refining – venting “IE” – in total venting
- Gas production starting year 2003 or 2005?
- Gas distribution – AD from MOLDOVAGAS – good correspondence with apparent consumption AD from energy balance
- LPG transport – AD from Energy balance
- Measurements for venting are available

Fugitive emission

Potential Improvements / Recommendations:

- Well drilling, testing, servicing:

There is a choice use IPCC 2006 or IPCC 1996 and GPG 2006

I recommend to use IPCC 1996 and GPG 2006

(AD – number of well, EFs – GPG 2000)

- Provide more transparent information in NIR on number of wells (time series disaggregated by oil and gas and by year of drilling, testing and service), gas production starting years, etc.)

Gas transport:

- Use tier 3 (measurement data) but be careful with time series, and measurement representativeness. Provide all transparent information in the NIR

International aviation (bunker fuel)

- Tier 2 method
- AD on LTO cycles from aviation companies
- AD on fuel used from official letters
- EF – from the IPCC 2006
- Not all plane types has default EFs, than average EF planes from the same countries is used

Potential Improvements / Recommendations:

- Check average CO₂ EF used
- Check NO_x and N₂O EFs

Thank you:

- for your hard work on the national inventory
- for your cooperation and transparency during the review

Thank you for attention!