United Nations

FCCC/TRR.4/LUX

Framework Convention on Climate Change

Distr.: General
28 May 2021

English only

Report on the technical review of the fourth biennial report of Luxembourg

Developed country Parties were requested by decision 2/CP.17 to submit their fourth biennial report to the secretariat by 1 January 2020. This report presents the results of the technical review of the fourth biennial report of Luxembourg, conducted by an expert review team in accordance with the "Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention". The review took place from 25 to 29 January 2021 remotely.

Contents

		Page
	Abbreviations and acronyms	3
I.	Introduction and summary	4
	A. Introduction	4
	B. Summary	4
II.	Technical review of the information reported in the fourth biennial report	5
	A. Information on greenhouse gas emissions and removals related to the quantified economy-wide emission reduction target	5
	B. Quantified economy-wide emission reduction target and related assumptions, conditions and methodologies	7
	C. Progress made towards achievement of the quantified economy-wide emission reduction target	8
	D. Provision of financial, technological and capacity-building support to developing country Parties	23
III.	Conclusions and recommendations	30
Annex		
	Documents and information used during the review	33

Abbreviations and acronyms

AEA	annual emission allocation
Annex I Party	Party included in Annex I to the Convention
AR	Assessment Report of the Intergovernmental Panel on Climate Change
BR	biennial report
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CTF	common tabular format
ERT	expert review team
ESD	European Union effort-sharing decision
ESR	European Union effort-sharing regulation
EU	European Union
EU ETS	European Union Emissions Trading System
F-gas	fluorinated gas
GAINS	Greenhouse gas – Air pollution Interactions and Synergies
GDP	gross domestic product
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
ICF	international climate finance
IPPU	industrial processes and product use
LULUCF	land use, land-use change and forestry
MECDD	Ministry of the Environment, Climate and Sustainable Development
NA	not applicable
NC	national communication
NE	not estimated
NECP	National Energy and Climate Plan
NF_3	nitrogen trifluoride
NO	not occurring
non-Annex I Party	Party not included in Annex I to the Convention
N_2O	nitrous oxide
ODA	official development assistance
PaMs	policies and measures
PFC	perfluorocarbon
PRIMES	Price-Induced Market Equilibrium System
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
SF_6	sulfur hexafluoride
STATEC	National Institute for Statistics and Economic Studies
UNFCCC reporting guidelines on BRs	"UNFCCC biennial reporting guidelines for developed country Parties"
UNFCCC reporting guidelines on NCs	"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications"
WAM	'with additional measures'
WEM	'with measures'
WOM	'without measures'

I. Introduction and summary

A. Introduction

1. This is a report on the centralized technical review of the BR4[1] of Luxembourg. The review was organized by the secretariat in accordance with the "Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention", particularly "Part IV: UNFCCC guidelines for the technical review of biennial reports from Parties included in Annex I to the Convention" (annex to decision 13/CP.20).

2. In accordance with the same decision, a draft version of this report was transmitted to the Government of Luxembourg, which provided comments that were considered and incorporated, as appropriate, with revisions into this final version of the report.

3. The review was conducted together with the review of four other Annex I Parties from 25 to 29 January 2021 remotely[2] by the following team of nominated experts from the UNFCCC roster of experts: Karin Kindbom (Sweden), Sekai Ngarize (Zimbabwe), Stephanie Ockenden (United Kingdom of Great Britain and Northern Ireland), Lilia Taranu (Republic of Moldova) and Songli Zhu (China). Ms. Zhu was the lead reviewer. The review was coordinated by Martina Kuehner, Karin Simonson and Nalin Srivastava (secretariat).

B. Summary

4. The ERT conducted a technical review of the information reported in the BR4 of Luxembourg in accordance with the UNFCCC reporting guidelines on BRs (annex I to decision 2/CP.17).

1. Timeliness

5. The BR4 was submitted on 21 January 2020, after the deadline of 1 January 2020 mandated by decision 2/CP.17. The BR4 CTF tables were also submitted on 21 January 2020. The BR4 and the CTF tables were resubmitted on 23 November 2020.

6. Luxembourg informed the secretariat on 2 January 2020 about its difficulties with making a timely submission. In accordance with decision 13/CP.20, a Party should inform the secretariat thereof by the due date of the submission in order to facilitate the arrangement of the review process. The ERT noted with concern the delay in the submission and recommended that Luxembourg make its next submission on time.

2. Completeness, transparency of reporting and adherence to the reporting guidelines

7. Issues and gaps identified by the ERT related to the reported information are presented in table 1. The information reported by Luxembourg in its BR4 mostly adheres to the UNFCCC reporting guidelines on BRs.

Table 1
Summary of completeness and transparency of mandatory information reported by Luxembourg in its fourth biennial report

Section of BR	*Completeness*	*Transparency*	*Reference to description of recommendation(s)*
GHG emissions and removals	Complete	Transparent	

[1] The BR submission comprises the text of the report and the CTF tables, which are both subject to the technical review.

[2] Owing to the circumstances related to the coronavirus disease 2019, the technical review of the BR submitted by Luxembourg had to be conducted remotely.

Section of BR	*Completeness*	*Transparency*	*Reference to description of recommendation(s)*
Quantified economy-wide emission reduction target and related assumptions, conditions and methodologies	Complete	Mostly transparent	Issue 1 in table 3
Progress in achievement of targets	Mostly complete	Partially transparent	Issues 1 and 2 in table 5 Issue 1 in table 7 Issues 2, 3 and 8 in table 11
Provision of support to developing country Parties	Mostly complete	Transparent	Issues 1, 2 and 4 in table 14

Note: A list of recommendations pertaining to the completeness and transparency issues identified in this table is included in chap. III below. The assessment of completeness and transparency by the ERT in this table is based only on the "shall" reporting requirements.

II. Technical review of the information reported in the fourth biennial report

A. Information on greenhouse gas emissions and removals related to the quantified economy-wide emission reduction target

1. Technical assessment of the reported information

8. Total GHG emissions[3] excluding emissions and removals from LULUCF decreased by 17.2 per cent between 1990 and 2018, whereas total GHG emissions including net emissions or removals from LULUCF decreased by 19.5 per cent over the same period. The changes in total emissions were driven mainly by factors such as changes in the energy mix (although overall primary energy consumption increased between 1990 and 2018, solid fuel and coal have been replaced by liquid fuels and biofuels); structural changes in the energy and industrial sectors (including changes in steel production processes and the implementation of more efficient cogeneration facilities); and an increase in fuel consumption from road transportation (including a significant share of fuel being purchased by non-residents of Luxembourg).

9. The ERT noted that, in the description of emissions and removals in the LULUCF sector, the Party reported a 47.0 per cent increase in removals between 2017 and 2018 without providing an explanation for this significant change. During the review, Luxembourg explained the key drivers of emissions and removals in the LULUCF sector and indicated that the overall decrease in emissions was due to the ongoing increase in net removals in forest land remaining forest land following the recovery from major disturbance events in the early 1990s. Luxembourg also indicated that it will provide a short overview of LULUCF source and sink emission estimates and trends in the next BR.

10. Table 2 illustrates the emission trends by sector and by gas for Luxembourg. Note that information in this paragraph and table 2 is based on Luxembourg's 2020 annual submission, version 3, which has been subject to review.[4] All emission data in subsequent chapters are based on Luxembourg's BR4 CTF tables unless otherwise noted. The emissions reported in the 2020 annual submission differ from the data reported in CTF table 1, which are based on the 2019 annual submission.[5]

[3] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.

[4] At the time of the BR4 review, Luxembourg's 2020 annual submission had been reviewed, but the inventory review report had not yet been published.

[5] Owing to limitations in the CRF Reporter software, the Party was not able to provide estimates from the latest inventory available (i.e. 2020) at the time it resubmitted the CTF tables in November 2020. Information in the CTF tables (version 3) therefore reflects estimates from the 2019 inventory.

Table 2
Greenhouse gas emissions by sector and by gas for Luxembourg for 1990–2018

	GHG emissions (kt CO_2 eq)					*Change (%)*		*Share (%)*	
	1990	*2000*	*2010*	*2017*	*2018*	*1990–2018*	*2017–2018*	*1990*	*2018*
Sector									
1. Energy	10 300.98	8 088.16	10 738.32	8 794.37	9 112.19	–11.5	3.6	80.8	86.4
A1. Energy industries	35.64	119.03	1 204.97	242.78	223.60	527.3	–7.9	0.3	2.1
A2. Manufacturing industries and construction	6 265.75	1 397.41	1 267.28	1 144.58	1 164.30	–81.4	1.7	49.2	11.0
A3. Transport	2 617.10	4 871.10	6 520.50	5 648.16	6 028.73	130.4	6.7	20.5	57.2
A4. and A5. Other	1 363.10	1 670.65	1 691.61	1 727.54	1 664.59	22.1	–3.6	10.7	15.8
B. Fugitive emissions from fuels	19.39	29.98	53.96	31.32	30.98	59.8	–1.1	0.2	0.3
C. CO_2 transport and storage	NO	NO	NO	NO	NO	–	–	–	–
2. IPPU	1 639.38	781.18	675.77	659.63	662.58	–59.6	0.4	12.9	6.3
3. Agriculture	695.57	694.56	659.90	697.69	690.44	–0.7	–1.0	5.5	6.5
4. LULUCF	101.25	–717.53	–119.48	–402.41	–213.28	–310.7	–47.0	NA	NA
5. Waste	105.14	105.21	95.07	84.00	81.93	–22.1	–2.5	0.8	0.8
6. Other[a]	NO	NO	NO	NO	NO	–	–	–	–
Gas[b]									
CO_2	11 847.64	8 731.57	11 219.29	9 250.40	9 568.52	–19.2	3.4	93.0	90.7
CH_4	581.65	585.41	591.66	593.66	587.66	1.0	–1.0	4.6	5.6
N_2O	310.50	318.68	297.15	312.14	313.13	0.8	0.3	2.4	3.0
HFCs	0.00	31.08	53.67	69.58	67.64	94 601 051.4	–2.8	0.0	0.6
PFCs	NO	NO	NO	NO	NO	–	–	–	–
SF_6	1.28	2.36	7.29	9.90	10.20	694.9	3.0	0.0	0.1
NF_3	NO	NO	NO	NO	NO	–	–	–	–
Total GHG emissions excluding LULUCF	**12 741.06**	**9 669.11**	**12 169.06**	**10 235.70**	**10 547.15**	**–17.2**	**3.0**	**100.0**	**100.0**
Total GHG emissions including LULUCF	**12 842.31**	**8 951.57**	**12 049.58**	**9 833.28**	**10 333.88**	**–19.5**	**5.1**	–	–

Source: GHG emission data: Luxembourg's 2020 annual submission, version 1.
[a] Emissions and removals reported under the sector other (sector 6) are not included in the total GHG emissions.
[b] Emissions by gas excluding LULUCF. The Party did not report indirect CO_2 emissions.

11. In brief, Luxembourg's national inventory arrangements were established in accordance with the EU monitoring mechanism regulation (EU regulation 525/2013). The Party presented information on its domestic institutional arrangements, including institutional, legal, administrative and procedural arrangements used for domestic compliance, monitoring, reporting, archiving of information and evaluation of the progress towards the economy-wide emission reduction target. Domestic institutional arrangements are covered by the Grand Ducal Regulation of 24 April 2017 on the establishment of a national system for the monitoring, assessment and reporting of GHG emissions and air pollutants and the reporting of other information relating to climate change and air pollution. There have been no changes in these arrangements since the BR3.

2. Assessment of adherence to the reporting guidelines

12. The ERT assessed the information reported in the BR4 of Luxembourg and recognized that the reporting is complete, transparent and thus adhering to the UNFCCC reporting guidelines on BRs. No issues relating to the topics discussed in this chapter of the review report were raised during the review.

B. Quantified economy-wide emission reduction target and related assumptions, conditions and methodologies

1. Technical assessment of the reported information

13. For Luxembourg the Convention entered into force on 7 August 1994. Under the Convention Luxembourg committed to contributing to the achievement of the joint EU economy-wide emission reduction target of 20 per cent below the 1990 level by 2020.

14. The target for the EU and its member States is formalized in the EU 2020 climate and energy package. The legislative package regulates emissions of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 using GWP values from the AR4 to aggregate the GHG emissions of the EU until 2020. Emissions and removals from the LULUCF sector are not included in the quantified economy-wide emission reduction target under the Convention. The EU generally allows its member States to use units from the Kyoto Protocol mechanisms for compliance purposes, subject to a number of restrictions in terms of origin and type of project and up to an established limit. Operators and airline operators can use such units to fulfil their requirements under the EU ETS, and member States can use such units for their national ESD targets, within specific limitations.

15. The EU 2020 climate and energy package includes the EU ETS and the ESD (see paras. 31–32 below). The EU ETS covers mainly point emissions sources in the energy, industry and aviation sectors. An EU-wide emission cap has been put in place for 2013–2020 with the goal of reducing emissions by 21 per cent below the 2005 level by 2020. For 2030, a reduction target of 43 per cent below the 2005 level has been set for emissions covered by the EU ETS. Emissions from ESD sectors are regulated through member State specific targets that add up to a reduction at the EU level of 10 per cent below the 2005 level by 2020. The ESR, successor to the ESD, was adopted in 2018 with a target of reducing covered emissions by 30 per cent below the 2005 level by 2030.

16. The European Commission set out its vision for a climate-neutral EU in November 2018, and in December 2019 presented the European Green Deal as a road map with actions for making the EU economy sustainable. The European Council endorsed in December 2019 the objective of making the EU climate-neutral by 2050. As part of the European Green Deal, the Commission proposed in March 2020 to enshrine the 2050 climate-neutrality target into the first European Climate Law. The European Green Deal calls for increasing the ambition of the 2030 emission reduction target to at least 50 per cent below the 1990 level. Member States will set out any increased ambition in the update of their NECPs.

17. The EU submitted its updated nationally determined contribution on 17 December 2020. The EU and its member States, acting jointly, are committed to a binding target to reduce net domestic GHG emissions by at least 55 per cent below the 1990 level by 2030. This new target will enable the EU to move towards a low-carbon economy, achieve climate-neutrality by 2050 under the European Green Deal legislative package and implement its commitments under the Paris Agreement.

18. Luxembourg has a national target of reducing its emissions to 20 per cent below the 2005 level by 2020 for ESD sectors. This target has been translated into binding quantified AEAs for 2013–2020. Luxembourg's AEAs change following a linear path from 9,539.55 kt CO_2 eq in 2013 to 8,116.94 kt CO_2 eq in 2020.[6]

19. In addition to its 2020 national target, Luxembourg has a longer-term target for 2030. Under the ESR, Luxembourg has a binding target to reduce emissions from the covered sectors to 40 per cent below the 2005 level by 2030; however, Luxembourg has also unilaterally committed to a more ambitious national target of 55 per cent below the 2005 level by 2030. This commitment is reflected in Luxembourg's NECP, which was submitted to the European Commission in May 2020. As part of its NECP, Luxembourg has further committed to national objectives for renewable energy sources to account for 25 per cent of primary energy consumption by 2030, and to achieve a 40–44 per cent improvement in

[6] According to the EU transaction log.

energy efficiency by 2030 compared with the 2007 level. Luxembourg's national target for 2030 is enshrined in the Climate Protection Law, which was adopted in December 2020.

20. Luxembourg has not yet submitted a long-term low GHG emission development strategy, but is working towards identifying the main areas of focus and the measures needed to reach climate-neutrality by 2050. The 2050 goal is addressed in the Climate Protection Law.

2. Assessment of adherence to the reporting guidelines

21. The ERT assessed the information reported in the BR4 of Luxembourg and identified an issue relating to transparency and thus adherence to the UNFCCC reporting guidelines on BRs. The finding is described in table 3.

Table 3
Findings on the assumptions, conditions and methodologies related to the quantified economy-wide emission reduction target from the review of the fourth biennial report of Luxembourg

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation*
1	Reporting requirement specified in paragraph 5 Issue type: transparency Assessment: recommendation	The ERT noted two issues regarding the transparency of information in the CTF tables: in CTF table 2(b), the Party reported the LULUCF sector as included in the target; and in CTF table 2(c), the Party left the cells for the GWP values for PFCs and NF_3 empty without providing an explanation. During the review the Party indicated that it will address the reporting of information in the CTF tables in the next submission. The ERT recommends that Luxembourg provide consistent information as to which sectors are included in the target and complete all cells in the CTF tables.

Note: Item listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on BRs. The reporting on the requirements not included in this table is considered to be complete, transparent and thus adhering to the UNFCCC reporting guidelines on BRs.

C. Progress made towards achievement of the quantified economy-wide emission reduction target

1. Mitigation actions and their effects

(a) Technical assessment of the reported information

22. Luxembourg provided information on its package of PaMs implemented and adopted, by sector and by gas, in order to fulfil its commitments under the Convention. Luxembourg reported on its policy context and legal and institutional arrangements in place for implementing its commitments and monitoring and evaluating the effectiveness of its PaMs.

23. Luxembourg's set of PaMs is similar to that previously reported. Changes in the package of PaMs include the expiration of some PaMs that were previously reported. The PaMs reported in the BR4 are those from the second national Action Plan for Reducing CO_2 Emissions (2013). During the review, Luxembourg explained that the PaMs proposed in the NECP (officially issued in May 2020) are still regarded as proposals that need to be more precisely defined, and some of them might be amended or modified following in-depth discussions with relevant public bodies. Luxembourg therefore considered it premature to include the proposed NECP PaMs in its BR4. Luxembourg indicated that the NECP list of PaMs should be available in time for inclusion in its next BR.

24. Luxembourg also indicated that there have been no changes since its previous submission to its institutional, legal, administrative and procedural arrangements used for domestic compliance, monitoring, reporting, archiving of information and evaluation of progress towards its target. Annex 2 to the Grand Ducal Regulation of 24 April 2017 specifies the sector experts or competent institutions responsible for projections and for the ex ante and ex post evaluation of PaMs. The sector experts are responsible for choosing appropriate methods, carrying out the evaluations and reassessing the effects of PaMs where changes

have occurred. A focal point located in MECDD acts as the projections and PaMs coordinator. The focal point is also responsible for documentation and archiving, and for providing the single national entity with information on the preparation of projections and evaluation of PaMs, as well as on ways to improve them.

25. In its reporting on its PaMs, Luxembourg provided the estimated emission reduction impacts for some of its PaMs. While an estimate of the impact of some PaMs was provided for the energy, transport, industrial processes and waste sectors, none was provided for the agriculture or forestry sectors. Where estimated impacts were not provided, the Party explained during the review that the mitigation impact of many PaMs had not been estimated because of a lack of human resources, capacity or knowledge.

26. The ERT noted several issues in relation to the transparency of reporting on PaMs: no explanation was provided for the use of the notation key "NA" for some of the PaMs where no mitigation estimates were provided; there were inconsistencies between the BR4 and CTF table 3 (e.g. the mitigation impact for one agricultural measure (AG 21) was estimated in CTF table 3 but reported as "NE" in the BR4 text); and there were differences in the start year for implementation and gases covered for some PaMs. During the review, Luxembourg provided an explanation for reporting "NA" for individual PaMs; namely, this notation key was used (1) for PaMs that do not yield direct emission reductions and (2) to avoid possible double counting, such as for planning instruments or economic instruments providing financial support to individual actions or measures. Luxembourg estimated the impacts of some of its PaMs in groups. The Party explained that impacts were estimated in some cases for groups of PaMs because of overlapping effects and to avoid double counting.

27. The Party described the different methodologies used for estimating the impacts of its individual or groups of PaMs. For energy PaMs, the methodologies included estimating energy savings in buildings that must meet strict energy efficiency standards. In the transport sector, mitigation impacts were estimated on the basis of an increase in vehicle taxes and assumptions on reduced fuel consumption as a result of those taxes. For the industrial processes sector, the methodology for estimating the avoided F-gas emissions compared the implementation of the EU F-gas regulation (2014/517/EC) with a 'business as usual' scenario extrapolated from the historical trend in emissions. In the waste sector, the methodologies for estimating mitigation impact included making assumptions on the impact of not having installed CH_4 recovery systems, determining the reduction in CH_4 emissions resulting from requirements for aerobic pre-treatment of waste prior to landfilling, and comparing the potential effects of using energy from wood waste with using energy from fossil fuels.

28. Luxembourg's self-assessment of compliance with its emission reduction targets includes identifying non-sustainable trends through its National Sustainable Development Plans, of which the latest (the third) was adopted in December 2019. Longer-term national objectives will be framed through the Third Industrial Revolution Strategy Study and through the implementation of Agenda 2030, in association with the third National Sustainable Development Plan. Luxembourg's progress in establishing national rules for taking action against non-compliance includes the Climate Protection Law, adopted by Parliament in December 2020. The law lays down progressive and binding emission targets for five sectors (energy and industry, transport, buildings, agriculture and forestry, and waste). The targets will be defined by a regulation setting AEAs, with possible penalties for non-compliance. The penalties will contribute to the revenue of the Climate and Energy Fund.

29. The key overarching related cross-sectoral policy in the EU is the 2020 climate and energy package, adopted in 2009, which includes the revised EU ETS and the ESD. The package is supplemented by renewable energy and energy efficiency legislation and legislative proposals on the 2020 targets for CO_2 emissions from cars and vans, the carbon capture and storage directive, and the general programmes for environmental conservation, namely the 7th Environment Action Programme and the clean air policy package. The 2030 climate and energy framework, adopted in 2014, includes more ambitious targets that will be updated as part of the European Green Deal.

30. The achievement of the Energy Union objectives and targets is ensured through a combination of Energy Union initiatives and national policies set out in integrated NECPs. The NECPs are periodically updated to reflect changes to EU policy, such as the

implementation of the European Green Deal. Luxembourg's NECP, which was officially published in May 2020, indicates that the key cross-sectoral measures include the Climate Protection Law; a measure introducing continuously adapted minimum carbon pricing; the further development of a current agreement with municipalities, the Climate Pact, which will act as a central instrument for implementing policy at the municipal level; and a measure to develop large-scale sustainable housing projects. For agriculture, the key measures in the NECP include elaborating a CH_4 reduction strategy, reducing the use of nitrogen fertilizers and implementing sustainable cultivation methods. In the energy sector, the aim of several proposed measures is to increase energy efficiency through a long-term renovation strategy involving establishing "nearly zero energy" standards and elaborating a support scheme for energy efficiency in industry and small and medium-sized enterprises. The expanded use of renewable energy will be promoted by continuing several existing policies on electricity and heating, and by reducing the share of fossil gas in heating networks by removing subsidies and replacing fossil gas with renewable energy sources. Proposals in the NECP for the transport sector include a road map for increasing the share of electromobility, a strategy on using second-generation biofuels, a vehicle tax reform that aligns with the polluter pays principle, and the introduction of free public transport, which has been in effect since 1 March 2020. In the waste sector, a new zero-waste strategy will be elaborated, as well as a strategy for the sustainable recirculation of sludge. The NECP also states that the invention and development of eco-technologies will be promoted through increased investments in energy research and development targeting, for example, sustainable buildings, energy efficiency and the circular economy, renewable energies, and mobility.

31. In operation since 2005, the EU ETS is a cap-and-trade system that covers all significant energy-intensive installations (mainly large point emissions sources such as power plants and industrial facilities), which produce 40–45 per cent of the GHG emissions of the EU. It is expected that the EU ETS will guarantee that the 2020 and 2030 targets (a 21 and 43 per cent emission reduction below the 2005 level, respectively) will be achieved for sectors under the scheme. The third phase of the EU ETS started in 2013 and the system now includes aircraft operations (since 2012) as well as N_2O emissions from chemical industry, PFC emissions from aluminium production and CO_2 emissions from some industrial processes that were not covered in the previous phases of the EU ETS (since 2013). Auctioning is the default method for allocating allowances; however, harmonized rules for free allocations, based on benchmark values achieved by the most efficient 10 per cent of installations, are still in place as a safeguard for the international competitiveness of industrial sectors at risk of carbon leakage.

32. The ESD became operational in 2013 and covers transport (excluding domestic and international aviation, and international maritime transport), residential and commercial buildings, agriculture and waste, together accounting for 55–60 per cent of the GHG emissions of the EU. The ESD includes binding annual targets for each member State for 2013–2020. The ESR sets national emission reduction targets for 2030 ranging from 0 to 40 per cent below the 2005 level, and trajectories with annual limits for 2021–2030, for all member States, and keeps many of the flexibilities of the ESD. Luxembourg has unilaterally committed to reducing emissions to 55 per cent below the 2005 level by 2030.

33. Luxembourg highlighted the EU-wide mitigation actions that are under development, such as the proposal by the European Commission during 2020 to increase the EU-wide ambition to cut GHG emissions by at least 55 per cent below the 1990 level by 2030. This proposal is intended to deliver on the commitments made in the European Green Deal and is in line with the goal of the Paris Agreement to keep the global average temperature increase to well below 2 °C and pursue efforts to limit it to 1.5 °C.

34. Luxembourg introduced national-level policies to achieve its targets under the ESD and domestic emission reduction targets. The key overarching cross-sectoral policy reported by Luxembourg is the 2013 second Action Plan for Reducing CO_2 Emissions. The key policies reported are increasing efficiency standards in residential and non-residential buildings; applying feed-in tariffs for renewable electricity and heat cogeneration; applying feed-in tariffs for biogas supply; developing the framework and infrastructure for low-carbon fuels and electric cars; and introducing 'Kyoto-cent', an additional tax on every litre of petrol

and diesel sold. The mitigation effect of the waste management measure on reducing landfilling of municipal solid waste is the most significant.

35. Luxembourg also reported on a cross-sectoral policy for diversifying the country's economy and using public funds to promote eco-technologies. The aim of the policy is to make better use of public financial support for eco-technological research and development projects, as well as better integrate research and development, private sector innovation, and cross-sectoral cooperation through a 'clean technology' cluster to strengthen Luxembourg's position in the green economy. In addition, the Third Industrial Revolution Strategy Study provides the framework for future climate policies and for Luxembourg to meet its emission reduction target for 2020. The study is a joint process, bringing together a number of stakeholders to exchange ideas and tools for the transition to a new economic model defined by the coupling of information technologies, renewable energy sources and intelligent transport networks. The ERT identified the Climate Pact as a mitigation action of particular interest because of its potential to engage local stakeholders. Under the agreement, municipalities commit to implementing a quality management system for their energy and climate policy, aiming at expanding the use of sustainable energy in electricity generation and heating and facilitating a systematic review of energy-related activities.

36. Luxembourg highlighted the domestic mitigation actions that are adopted but not yet implemented, such as monitoring energy efficiency in public buildings with the aim of reducing energy consumption. Another adopted measure covers training and education, offering certificates of competence for industrial and small and medium-sized enterprise end users with the aim of improving the deployment of energy efficiency and renewable energy projects. Luxembourg also briefly described in its BR4 the mitigation actions proposed in the NECP (adopted in May 2020) that are under development. Table 4 provides a summary of the reported information on the PaMs of Luxembourg.

Table 4
Summary of information on policies and measures reported by Luxembourg

Sector	*Key PaMs*	*Estimate of mitigation impact in 2020 (kt CO_2 eq)*	*Estimate of mitigation impact in 2030 (kt CO_2 eq)*
Policy framework and cross-sectoral measures	Second Action Plan for Reducing CO_2 Emissions	NE	NE
Energy			
Energy efficiency	Climate agreement with the municipalities (Climate Pact)	NA	NA
	Increased energy efficiency standards in non-residential buildings	24.67	49.16
	Increased energy efficiency standards in residential buildings	10.62	10.62
Energy supply and renewables	Feed-in tariffs for renewable electricity and heat cogeneration	23.18	23.18
	Feed-in tariffs for biogas supply	9.50	9.50
Transport	Sustainable mobility strategy (MoDu 2.0)	NA	NA
	Framework and infrastructure development for low-carbon fuels and electric cars	17.05	NE
	Excise duties on fuel for transport purposes ('Kyoto-cent')	19.75	NE
IPPU	EU F-gas regulation (2014/517/EC)	9.87	87.86
Agriculture	EU Common Agricultural Policy – livestock management	NE	NE
	EU Rural Development Programme – land management	NE	NE
LULUCF	Conservation of carbon in existing forests	NE	NE
Waste	Reduced landfilling of municipal solid waste	65.50	89.75
	CH_4 recovery systems	6.66	6.66

Sector	*Key PaMs*	*Estimate of mitigation impact in 2020 (kt CO_2 eq)*	*Estimate of mitigation impact in 2030 (kt CO_2 eq)*
	Separate collection and treatment of biowaste	3.18	3.18

Note: The estimates of mitigation impact are estimates of emissions of CO_2 eq avoided in a given year as a result of the implementation of mitigation actions.

(b) Policies and measures in the energy sector

37. **Energy efficiency.** The second Action Plan for Reducing CO_2 Emissions of 2013 is Luxembourg's main policy document for complying with its commitments under the EU 2020 climate and energy package. In this second Action Plan, actions are mainly focused on increasing energy efficiency in all sectors, as well as on promoting the use of renewable energy sources (i.e. biomass, solar, wind, hydroelectric and geothermal installations). The fourth National Energy Efficiency Action Plan, published by the Ministry of the Economy in 2017, sets out estimated energy consumption, planned energy efficiency measures, long-term renovation strategies and the improvements that Luxembourg expects to achieve in order to reach the EU-wide 2020 target of a 20 per cent increase in energy efficiency.

38. Luxembourg's energy efficiency PaMs promote the use of renewable energy sources through direct allowances and payments for installing devices that offer the possibility of using renewable energy sources (e.g. solar energy equipment), or for renovating or constructing low-energy (passive) houses. The direct subsidies also cover cashback schemes and other financial incentives, such as partial refunding of the purchase price of a low-energy electrical appliance. Actions also correspond to subsidy schemes for the production of 'green' energy, such as a bonus (feed-in tariff) offered for electricity production from wind, biomass or biogas or at hydroelectric installations. Luxembourg has established improved energy efficiency standards (for heating and hot water) for residential buildings and for new and existing non-residential buildings. The quantified measures are expected to achieve emission reductions of about 35.20 kt CO_2 eq in 2020. Energy efficiency PaMs targeting individual sectors are discussed below.

39. **Energy supply and renewables.** The EU 2020 climate and energy package defines differentiated commitments and targets by 2020 for each EU member State; for Luxembourg, in the area of renewable energy, the target is to achieve an 11 per cent share of energy from renewable sources in all forms in final energy consumption, and a 10 per cent share of energy from renewable sources for transport. The National Renewable Energy Action Plan provides a detailed road map of how Luxembourg expects to reach its 2020 target for the share of renewable energy in final energy consumption. Luxembourg has established feed-in tariffs to promote the use of renewable sources (waste wood, pellets and sewage gas) for producing electricity and heat, and to promote the use of biogas as a substitute for natural gas. The quantified measures are expected to achieve emission reductions of about 32.68 kt CO_2 eq in 2020.

40. In late 2017 Luxembourg signed cooperation agreements with Lithuania and Estonia for 2018–2020 setting the terms for statistical transfers (i.e. obligation sharing) in line with the framework established in the National Renewable Energy Action Plan. According to these agreements, the transferred revenues will benefit the transition to renewable energy sources and the financing of renewable energy and energy efficiency projects. Thanks to these agreements, Luxembourg was able to reach the indicative trajectory for 2017–2018 of 7.56 per cent, which was initially set at 7.47 per cent. Luxembourg communicated during the review that its 11 per cent target will be reached by increasing the national deployment of renewable energy technologies, and by using the European cooperation mechanism in the form of statistical transfers (as foreseen in article 6 of the EU directive on renewable energy).

41. **Residential and commercial sectors.** Luxembourg provided information in its BR4 on a number of PaMs targeting emission reductions in the residential and commercial sectors, many of which overlap with the energy efficiency PaMs described above. A series of reinforced building-related PaMs for new residential buildings are proposed in the NECP. These measures would strengthen existing energy efficiency standards for new buildings with regard to heating and hot water, which have been in place since 2017. The proposed revisions

include introducing a new A+ energy class to cover 100 per cent of the energy needs of new residential buildings by renewable energy sources through the PRIMe House scheme. This scheme offers grants and subsidies for the energy and sustainable renovation of residential buildings, as well as expert energy advice on constructing sustainable residential buildings and using renewable energies. The legislative package Climate Bank and Subsidies for Sustainable Housing, adopted in 2017, promotes the construction of and renovation to sustainable and energy-efficient residential buildings by supporting the use of renewable energy in buildings. These aims are achieved through support from the Climate Bank, which offers either a reduced-rate loan or a zero-rate loan; and LENOZ, a certification system for new and sustainable residential buildings that relies on three sustainability pillars: protection of the environment, economic efficiency and social justice.

42. **Transport sector.** Since road fuel sales to non-residents is the main contributor to GHG emissions in Luxembourg, as underlined in the second Action Plan for Reducing CO_2 Emissions, the Party will use a combination of policy instruments with the aim of progressively reducing emissions relating to road transport. The Transport Sector Plan is one of the national primary sector plans linked to the general long-term planning concept of integrated spatial development and transport. The Plan, in which objectives for the 2020 horizon are fixed, is the regulatory counterpart of the sustainable mobility strategy (MoDu).

43. The Party communicated during the review its key measures to limit transport emissions, including the sustainable mobility strategy (MoDu 2.0) of 2018, the aim of which is to increase the share of public transport and the use of 'soft' transport modes (cycling and walking); the obligation to increase the use of biofuels in transport-related fuels; purchase incentives for zero- and low-emission vehicles to promote electric mobility; charging infrastructure development and the mandatory purchase of zero- or low-emission vehicles for public fleets; the new Climate Protection Law adopted in 2020; and the carbon tax in place from 1 January 2021 (EUR 20/t CO_2, rising to EUR 25 in 2022 and EUR 30 in 2023).

44. Luxembourg has set up an interministerial working group composed of representatives of the Ministry of Finance, the Ministry for Energy and Spatial Planning, MECDD, the Ministry of the Economy, the Customs and Excise Administration and STATEC. This group, chaired by the Ministry of Finance, is responsible for detailed and regular monitoring of the evolution of road fuel sales; monitoring the impacts of the new measures proposed by the Government within the framework of an overall tax reform in Luxembourg; and analysing the desirability of introducing a tax segmentation between professional use and private use of diesel (similar to the systems in place in Belgium and France), coupled with an increase in 'Kyoto-cent'.

45. Luxembourg has established a vehicle tax based on CO_2 emissions whereby a fuel consumption reduction rate of 2 per cent is applied annually until 2020 for new diesel and petrol vehicles, and increased taxes on petrol and diesel (a price elasticity rate of 1.6 per cent for 2017, 2018, 2019 and 2020 is applied). These measures are expected to achieve emission reductions of about 36.8 kt CO_2 eq in 2020.

46. **Industrial sector.** The main PaMs in the industrial sector are the EU ETS and a voluntary energy efficiency agreement between Luxembourg, the energy agency My Energy and the Business Federation of Luxembourg that addresses the energy consumption of the industrial sector, which includes enterprises participating in the EU ETS. The common objective of the voluntary agreement is to increase energy efficiency by 1 per cent annually, calculated for all participating enterprises. In order to reach this 1 per cent goal, each participating company prepares a technical evaluation (an energy audit) that enables it to define an action plan and put it into practice. As at the end of 2019, the majority of the country's large industrial energy consumers were participating in this voluntary agreement.

(c) Policies and measures in other sectors

47. **Industrial processes.** The key measure for the industrial processes sector is the EU ETS, which includes significant CO_2 emissions for the industrial sector. The only measure specific to the industrial processes sector concerns the implementation of the EU F-gas regulation. The regulation includes a phase-down of F-gases on the market and bans the use of F-gases in certain applications.

48. **Agriculture.** The main PaMs in the agriculture sector relate to the implementation of the EU Common Agricultural Policy and the EU Rural Development Programme. The aims of two additional national economic PaMs are to improve cropland management by converting conventional agriculture to organic agriculture and to increase the carbon stock in agricultural soils.

49. **LULUCF.** In the forestry sector, the aims of the main regulatory PaMs are to conserve carbon in existing forests by requiring forestry management plans; prohibit clear-cutting and deforestation without previous authorization; and provide compensation through afforestation. Other important PaMs relate to increasing the area of undisturbed forests and the amount of deadwood. There is also a voluntary agreement to increase the use of wood from forests by adopting a circular economy approach.

50. **Waste management.** The key overarching policy for the waste sector is the national waste management plan, through which the Party aims to promote measures related to the prevention and management of waste and, as such, does not include quantitative targets. Most waste PaMs are regulatory instruments, some of which relate to implementation of EU policy, such as the directives on waste landfill, waste incineration and waste packaging. Additional national regulatory PaMs aim at, for example, increasing CH_4 collection and use through CH_4 recovery systems and anaerobic digestion at biogas facilities. Other national PaMs include the polluter pays principle and regulations on managing biowaste and reducing the use of plastic bags.

(d) Response measures

51. Luxembourg's assessment of the economic and social consequences of its response measures includes complying with the ecological and social criteria established in the framework of the approval procedures of the UNFCCC for projects under the clean development mechanism and joint implementation. In this context, Luxembourg has established procedures for evaluating the environmental, social and economic aspects of projects on the one hand, and the sustainability and cost-effectiveness of the projects on the other hand. Projects must not involve nuclear or LULUCF activities, large hydroelectric projects have to demonstrate compliance with the recommendations of the World Commission on Dams, and projects shall not be located in a prohibited host country. Policy measures on biofuels ensure that the conditions are set out in such a way that biofuels do not compete with food production or cause degradation of valuable ecosystems. Luxembourg's initiatives aimed at minimizing adverse impacts are focused on harmonizing consumption taxes for fuel in agriculture and ensuring there are no subsidies for environmentally unsound and unsafe technologies.

(e) Assessment of adherence to the reporting guidelines

52. The ERT assessed the information reported in the BR4 of Luxembourg and identified issues relating to transparency and thus adherence to the UNFCCC reporting guidelines on BRs. The findings are described in table 5.

Table 5
Findings on mitigation actions and their effects from the review of the fourth biennial report of Luxembourg

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement specified in paragraph 6 Issue type: transparency Assessment: recommendation	The ERT noted several inconsistencies between the BR and CTF table 3. For example, the mitigation impact for one agriculture measure (AG 21) was estimated in CTF table 3 but reported as "NE" in the BR text. There were also differences in the start year for implementation and gases covered for some PaMs in the energy sector. During the review Luxembourg explained that the mitigation impact reported for the agriculture measure was an error and should have been reported as "NE". The ERT recommends that Luxembourg improve the transparency of its reporting by ensuring consistent information is reported in the BR and the CTF tables with regard to PaMs. The ERT notes that inconsistencies could be explained through the use of notation keys or footnotes to CTF table 3, and providing an explanation for any notation keys used.
2	Reporting requirement specified in CTF table 3 Issue type: transparency Assessment: recommendation	The ERT noted that Luxembourg did not provide an estimate of mitigation impact for many of its mitigation actions, although in its BR3 the Party had explained that the work on estimating the impacts of PaMs would continue through capacity-building in 2018. Luxembourg did not provide an explanation for reporting "NA" for some of the PaMs that were not estimated. During the review Luxembourg informed the ERT that a new list of PaMs will soon come from the NECP process, and that a lack of human resources and capacity/knowledge is the reason why the mitigation impact of many PaMs has not been estimated to date. The Party also noted that "NA" is reported for those PaMs that do not yield direct emission reductions or to avoid possible double counting, such as for planning instruments or economic instruments providing financial support to individual actions or measures. The ERT reiterates the recommendation from the previous review report that Luxembourg improve the transparency of its reporting by providing the estimated effect of each mitigation action, or by providing a clear explanation in the text of the BR as to why this is not possible owing to national circumstances.

Note: Item listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on BRs. The reporting on the requirements not included in this table is considered to be complete, transparent and thus adhering to the UNFCCC reporting guidelines on BRs.

2. Estimates of emission reductions and removals and the use of units from market-based mechanisms and land use, land-use change and forestry

(a) Technical assessment of the reported information

53. Luxembourg does not intend to use units from market-based mechanisms under the Kyoto Protocol or other market-based mechanisms under the Convention to meet its commitment under the ESD. Given that the contribution of LULUCF activities is not included in the joint EU target under the Convention, the reporting of contributions of LULUCF activities is not applicable for Luxembourg. Table 6 illustrates Luxembourg's ESD emissions and use of units from market-based mechanisms for achieving its ESD target.

Table 6
Summary of information on the use of units from market-based mechanisms by Luxembourg for achieving its target

Year	*ESD emissions (kt CO_2 eq)*	*AEA (kt CO_2 eq)*	*Use of units from market-based mechanisms (kt CO_2 eq)*	*Annual AEA surplus/deficit (kt CO_2 eq)*	*Cumulative AEA surplus/deficit (kt CO_2 eq)*
2013	9 365.30	9 539.56	0.00	174.26	174.26
2014	8 858.31	9 340.28	0.00	481.97	656.23
2015	8 607.48	9 141.01	0.00	533.53	1 189.76
2016	8 524.45	8 941.74	0.00	417.29	1 607.05
2017	8 743.46	8 737.85	0.00	–5.61	1 601.44

Year	ESD emissions (kt CO_2 eq)	AEA (kt CO_2 eq)	Use of units from market-based mechanisms (kt CO_2 eq)	Annual AEA surplus/deficit (kt CO_2 eq)	Cumulative AEA surplus/deficit (kt CO_2 eq)
2018	9 075.52	8 530.88	0.00	–544.64	1 056.80

Sources: Luxembourg's BR4 and BR4 CTF table 4(b), information provided by the Party during the review and EU transaction log (AEAs).

Note: For a given year, a positive number (surplus) indicates that annual or cumulative ESD emissions were lower than the corresponding AEA or cumulative AEAs, while a negative number (deficit) indicates annual or cumulative ESD emissions were higher than the AEA or cumulative AEAs.

54. In assessing the progress towards achieving the 2020 joint EU target, the ERT noted that Luxembourg's emission reduction target for the ESD is 20 per cent below the base-year level (see para. 18 above). In 2018 Luxembourg's ESD emissions were 6.4 per cent (544.64 kt CO_2 eq) above the AEA. Luxembourg has a cumulative surplus of 1,056.80 kt CO_2 eq with respect to its AEAs between 2013 and 2018.

55. The ERT noted that Luxembourg is making progress towards its ESD target by implementing mitigation actions that are delivering emission reductions under the Convention.

(b) Assessment of adherence to the reporting guidelines

56. The ERT assessed the information reported in the BR4 of Luxembourg and identified an issue relating to transparency and thus adherence to the UNFCCC reporting guidelines on BRs. The finding is described in table 7.

Table 7
Findings on estimates of emission reductions and removals and on the use of units from market-based mechanisms and land use, land-use change and forestry from the review of the fourth biennial report of Luxembourg

No.	Reporting requirement, issue type and assessment	Description of the finding with recommendation
1	Reporting requirement specified in paragraph 10 Issue type: transparency	The ERT noted that, in CTF table 4, the Party reported the contribution from LULUCF as "NA", because this sector is excluded for all EU member States. Footnote 2 to CTF table 4 also indicates that the sector is not included in the 2020 target. However, the ERT also noted that, in CTF table 4(a)II, the Party included values for the LULUCF accounting contribution without explaining the apparent contradiction.
	Assessment: recommendation	During the review, the Party explained that it had attempted to follow the same approach as other EU member States in reporting on the LULUCF sector (i.e. by completing CTF table 4(a)II). The ERT recommends that Luxembourg increase reporting transparency by noting in CTF tables 4 and 4(a)II that the LULUCF sector is excluded from its target for 2020, for example by using custom footnotes or notation keys.

Note: Item listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on BRs. The reporting on the requirements not included in this table is considered to be complete, transparent and thus adhering to the UNFCCC reporting guidelines on BRs.

3. Projections overview, methodology and results

(a) Technical assessment of the reported information

57. Luxembourg reported updated projections for 2020 and 2030 relative to actual inventory data for 2018 under the WEM scenario. The WEM scenario reported by Luxembourg includes PaMs implemented and adopted until 2015 or 2018, depending on the models used to make the projection.

58. In addition to the WEM scenario, Luxembourg reported the WAM scenario. The WAM scenario includes planned PaMs. Luxembourg provided a definition of its scenarios, explaining that its WEM scenario includes policies such as the second Action Plan for Reducing CO_2 Emissions, issued in 2013, while its WAM scenario encompasses planned measures that are included in the NECP issued in May 2020. The definitions indicate that the

WAM scenario was prepared in accordance with the UNFCCC reporting guidelines on BRs; however, the WAM projections are not in line with the PaMs described in the PaMs section of the BR4, where the planned measures were taken from the second Action Plan (2013) instead of the NECP (2020).

59. The projections are presented on a sectoral basis, using different sectoral categories from those used in the reporting on mitigation actions, and on a gas-by-gas basis for CO_2, CH_4, N_2O, HFCs and SF_6 for 2020–2040. The projections are also provided in an aggregated format for each sector and for a Party total using GWP values from the AR4. Luxembourg reported on factors and activities affecting emissions for the energy, IPPU and agriculture sectors, but did not include such information for the LULUCF and waste sectors.

(b) Methodology, assumptions and changes since the previous submission

60. The methodology used for the preparation of the projections is different from that used for the preparation of the emission projections for the NC7. Luxembourg did not provide information on the changes since the submission of its NC7 in the assumptions, methodologies, models and approaches used for the projection scenarios. However, during the review, Luxembourg provided information further explaining the methodologies and indicating the changes made since the NC7: a new comprehensive model, the ISI-DELUX energy demand model, was developed and used to project emissions from fuel combustion (including road transportation) instead of the models used for the NC7 (namely, Econotec, STATEC-NEAM and Komobile); new projections for the agriculture sector were prepared by the Department for Rural Economy and used instead of the EU PRIMES and GAINS models; and new activity data derived from NECP were used in place of ad hoc projections for selected categories.

61. To prepare its projections, Luxembourg relied on key underlying assumptions relating to population, international energy prices, fuel tax, production of industrial products, number of cars, number of livestock, and so on. The Party also highlighted in the BR4 that GDP growth was not considered when preparing the projections because GDP growth is not a useful indicator given the size and composition of Luxembourg's economy. The assumptions were updated on the basis of the most recent research known at the time of the preparation of the projections (i.e. a consortium study led by the Fraunhofer Institute for the energy sector and a study led by the Department for Rural Economy for the agriculture sector).

(c) Results of projections

62. The projected emission levels under different scenarios and information on the quantified economy-wide emission reduction target are presented in table 8 and figure 1.

Table 8
Summary of greenhouse gas emission projections for Luxembourg

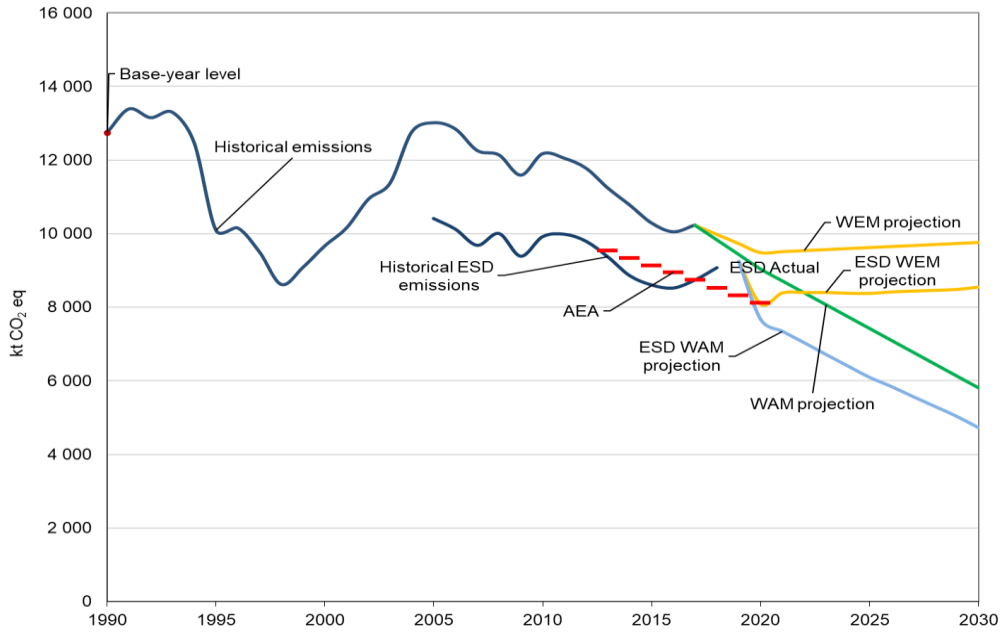
	Total GHG emissions		*Emissions under the ESD*	
	GHG emissions (kt CO_2 eq/year)	*Change in relation to 1990 level (%)*	*ESD emissions (kt CO_2 eq/year)*	*Difference from 2020 AEA (%)*
2020 AEA under the ESD[a]	NA	NA	8 116.94	NA
Inventory data 1990	12 741.07	–	NA	NA
Inventory data 2018	9 566.33	24.9	9 075.84	11.8
WEM projections for 2020	9 476.49	–25.6	8 087.07	–0.4
WAM projections for 2020	9 044.56	–29.0	7 669.92	–5.5
WEM projections for 2030	9 758.90	–23.4	8 549.88	5.3
WAM projections for 2030	5 805.44	–54.4	4 725.54	–41.8

Sources: Luxembourg's BR4 and BR4 CTF table 6, and EU transaction log (AEAs). Additional information on projections was provided by Luxembourg during the review. ESD emissions and projections data were provided by Luxembourg during the review.

Note: The projections are for GHG emissions excluding LULUCF and excluding indirect CO_2.

[a] The quantified economy-wide emission reduction target under the Convention is a joint target of the EU and its member States. The target is to reduce emissions by 20 per cent compared with the base-year (1990) level by 2020. Luxembourg's target under the ESD is 20.0 per cent below the 2005 level by 2020.

Figure 1
Greenhouse gas emission projections reported by Luxembourg



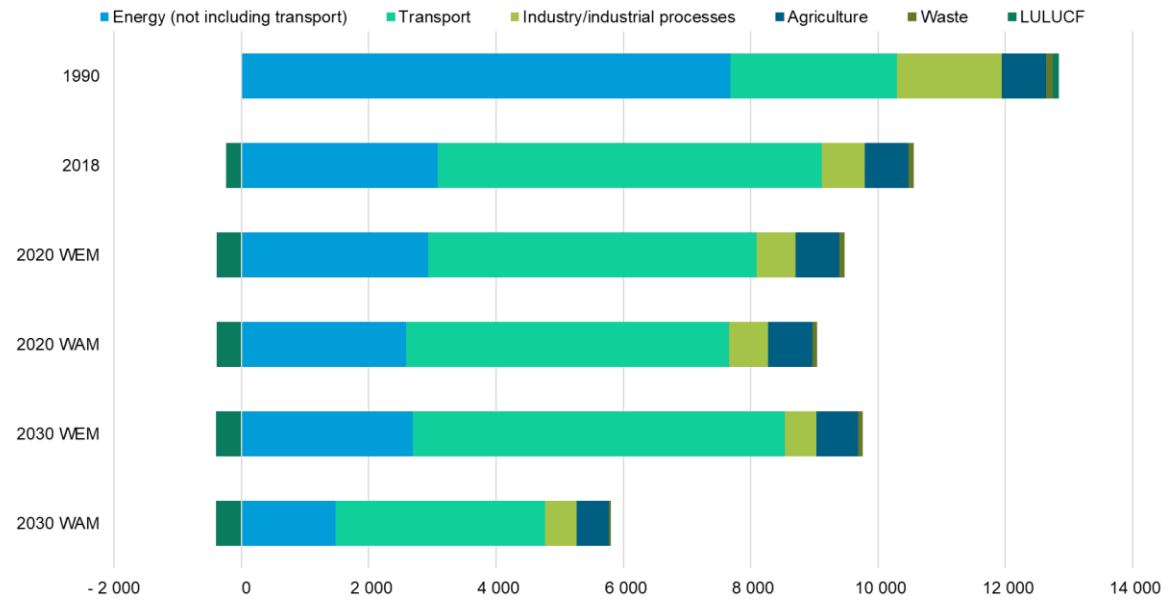
Sources: EU transaction log (AEAs) and Luxembourg's BR4 and BR4 CTF tables 1 and 6. Additional information on projections was provided by Luxembourg during the review. ESD emissions and projections data were provided by Luxembourg during the review.

63. Luxembourg's total GHG emissions excluding LULUCF in 2020 and 2030 are projected under the WEM scenario to decrease by 25.6 and 23.4 per cent, respectively, below the 1990 level. Under the WAM scenario, emissions in 2020 and 2030 are projected to be lower than those in 1990 by 29.0 and 54.4 per cent, respectively.

64. Luxembourg's target under the ESD is to reduce ESD emissions by 20 per cent below the 2005 level by 2020 (see para. 18 above). Luxembourg's AEAs, which correspond to its national emission target for ESD sectors, change linearly from 9,539.56 kt CO_2 eq in 2013 to 8,116.94 kt CO_2 eq for 2020. The projected level of emissions under the WEM and WAM scenarios is 0.4 and 5.5 per cent, respectively, below the AEAs for 2020. The ERT noted that the Party's cumulative surplus of AEAs is 1,056.80 kt CO_2 eq, which suggests that Luxembourg expects to meet its target under both the WEM and WAM scenarios.

65. Luxembourg presented the WEM and WAM scenarios by sector for 2020 and 2030, as summarized in figure 2 and table 9.

Figure 2
Greenhouse gas emission projections for Luxembourg presented by sector
(kt CO_2 eq)



Sources: Luxembourg's 2020 national GHG inventory report (as 2018 data could not be uploaded to BR CTF table 1). Additional information on projections was provided by Luxembourg during the review.

Table 9
Summary of greenhouse gas emission projections for Luxembourg presented by sector

	GHG emissions and removals (kt CO_2 eq)					*Change (%)*			
		2020		*2030*		*1990–2020*		*1990–2030*	
Sector	*1990*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*
Energy (not including transport)	7 683.88	2 931.86	2 582.43	2 694.15	1 482.96	–61.8	–66.4	–64.9	–80.7
Transport	2 617.10	5 158.06	5 077.85	5 844.39	3 290.31	97.1	94.0	123.3	25.7
Industry/industrial processes	1 639.38	613.22	613.22	489.00	489.00	–62.6	–62.6	–70.2	–70.2
Agriculture	695.57	693.00	690.69	662.73	506.12	–0.4	–0.7	–4.7	– 27.2
LULUCF	101.25	–390.10	–390.10	–400.62	–400.62	–485.3	–485.3	–495.7	–495.7
Waste	105.14	80.36	80.36	68.64	37.05	–23.6	–23.6	–34.7	–64.8
Other	–	–	–	–	–	–	–	–	–
Total GHG emissions excluding LULUCF	**12 741.07**	**9 476.49**	**9 044.56**	**9 758.90**	**5 805.44**	**–25.6**	**–29.0**	**–23.4**	**–54.4**

Source: Luxembourg's BR4 CTF table 6. Additional information on projections was provided by Luxembourg during the review.

66. According to the projections reported for 2020 under the WEM scenario, the most significant absolute emission reductions are expected to occur in the energy sector (excluding transport) and the IPPU sector, amounting to projected reductions of 61.8 and 62.6 per cent between 1990 and 2020, respectively. However, emissions are projected to grow significantly in the transport sector, increasing by 2,540.96 kt CO_2 eq between 1990 and 2020. The pattern of projected emissions reported for 2030 under the same scenario remains largely the same. The decrease in emissions from the energy sector (excluding transport) continues, with the projected emissions from the sector decreasing by a further 237.71 kt CO_2 eq from 2020, owing to the increasing energy efficiency in existing and new buildings, and an increase of the penetration level of renewable energy in the energy supply sector. Emissions from the IPPU sector are projected to decrease by 124.22 kt CO_2 eq between 2020 and 2030. Some reductions are also expected in the agriculture sector between 2020 and 2030 (a decrease of 30.27 kt CO_2 eq) owing to the fulfilment of sustainable and extensive agriculture and the reduction of nitrogen fertilization. However, emissions from the transport sector are projected

to increase by 686.33 kt CO_2 eq between 2020 and 2030, offsetting the reductions from other sectors. As a result, under the WEM scenario, the emissions (excluding LULUCF) in 2030 are higher than in 2020 by 3.0 per cent.

67. If additional measures are considered (i.e. under the WAM scenario), the patterns of emission reductions by 2020 presented by sector remain largely the same. A greater reduction is observed in the energy sector, amounting to projected reductions of 5,101.45 kt CO_2 eq between 1990 and 2020. Reductions in the IPPU sector remain similar to those in the WEM scenario. Moreover, the projected emission increase in the transport sector between 1990 and 2020 drops to 2,460.75 kt CO_2 eq. Between 2020 and 2030, emissions from all sectors are projected to decrease under the WAM scenario by 3,239.12 kt CO_2 eq.

68. Luxembourg presented the WEM and WAM scenarios by gas for 2020 and 2030, as summarized in table 10.

Table 10
Summary of greenhouse gas emission projections for Luxembourg presented by gas

	GHG emissions and removals (kt CO_2 eq)					*Change (%)*			
		2020		*2030*		*1990–2020*		*1990–2030*	
Gas	*1990*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*
CO_2[a]	11 847.64	8 514.14	8 082.09	8 845.66	5 140.23	–28.1	–31.8	–25.3	–56.6
CH_4	581.65	586.77	582.96	559.25	390.59	0.9	0.2	–3.9	–32.8
N_2O	310.50	297.49	301.42	308.44	229.07	–4.2	–2.9	–0.7	–26.2
HFCs	0.00	67.42	67.42	39.26	39.26	–	–	–	–
PFCs	–	–	–	–	–	–	–	–	–
SF_6	1.28	10.67	10.67	6.29	6.29	733.6	733.6	391.4	391.4
NF_3	–	–	–	–	–	–	–	–	–
Total GHG emissions without LULUCF	**12 741.07**	**9 476.49**	**9 044.56**	**9 758.90**	**5 805.44**	**–25.6**	**–29.0**	**–23.4**	**–54.4**

Source: Luxembourg's BR4 CTF table 6. Additional information on projections was provided by Luxembourg during the review.
[a] Luxembourg did not include indirect CO_2 emissions in its projections.

69. According to the projections for 2020 under the WEM scenario, the most significant absolute reductions are projected for CO_2 emissions: 28.1 per cent between 1990 and 2020, as a result of energy efficiency improvements and optimization of the energy mix. N_2O emissions are also projected to decrease between 1990 and 2020, by 4.2 per cent, owing to planting improvements in the agriculture sector. Under the WEM scenario for 2030, CH_4, HFC and SF_6 emissions are projected to decrease between 2020 and 2030 owing to the implementation of an F-gas regulation to limit emissions from F-gases, while CO_2 emissions are projected to increase by 331.52 kt during the same period owing to their growth in road transportation, both of which will reverse the general trend observed and projected for 1990–2020.

70. If additional measures are considered (i.e. under the WAM scenario), the patterns of emission reductions by 2020 presented by gas remain the same. But the patterns of emission reductions by 2030 are significantly different because emissions of all GHGs are projected to decrease, in particular CO_2 emissions, which are projected to decrease by 2,941.86 kt between 2020 and 2030 as a result of improved energy efficiency and higher uptake of electric vehicles in road transportation.

(d) Assessment of adherence to the reporting guidelines

71. The ERT assessed the information reported in the BR4 of Luxembourg and identified issues relating to completeness and transparency and thus adherence to the UNFCCC reporting guidelines on BRs. The findings are described in table 11.

Table 11
Findings on greenhouse gas emission projections reported in the fourth biennial report of Luxembourg

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement specified in paragraph 28 Issue type: completeness Assessment: encouragement	The ERT noted that the Party did not report a WOM scenario in its BR4. The Party briefly explained in the BR4 that, owing to a lack of internal capabilities, no WOM scenario was provided. It also reported in the BR4 that this is a planned improvement for the coming years that should be implemented alongside the regular evaluation of NECP PaMs. During the review Luxembourg explained that the construction of projections under a WOM scenario depends not only on a greater involvement of experienced experts, but also on the setting up of sectoral targets under the Paris Agreement and a more systematic evaluation of PaMs, which will not be feasible before the end of 2023. The ERT reiterates the encouragement from the previous review report for the Party to improve the completeness of its reporting by including WOM projections or by explaining why they were not provided.
2	Reporting requirement specified in paragraph 29 Issue type: transparency Assessment: recommendation	The Party reported projections under the WAM scenario in its BR4. However, the ERT noted that the WAM projections are not consistent with the planned PaMs presented in the PaMs section, because the PaMs underpinning the WAM projections are from the NECP that was issued in May 2020, and these planned PaMs are not presented and quantified in the PaMs section in detail, except in the informal introduction. The Party acknowledged the issue in the BR4 and clarified that the discrepancy will not occur in future because the NECP list of PaMs and their ex ante evaluation should be available in the next BR. During the review Luxembourg acknowledged and further explained that the NECP proposes a series of actions and measures, some of which are new, while others involve the continuation or the strengthening of existing PaMs (i.e. the 2013 second Action Plan for Reducing CO_2 Emissions). However, the list of PaMs under the NECP was not available when the BR4 was drafted. The ERT recommends that the Party include all the planned PaMs in the WAM scenario and ensure consistency between the planned PaMs reported in the PaMs section and the projections under the WAM scenario.
3	Reporting requirement specified in paragraph 34 Issue type: transparency Assessment: recommendation	The ERT noted that the Party presented the GHG projections in the BR4 using a combined approach: the projection of emissions from energy activities, including emissions from public electricity and heat production, industries and construction (including IPPU), road transportation, commercial and institutional buildings, and residential buildings; and emissions from agriculture, including those from fuel combustion in this sector and from agricultural activities themselves; while emissions from the waste sector are included in 'other source categories' together with those from categories not covered by the energy sector. This approach differs from that used in the PaMs section, where PaMs are presented by sector (energy, IPPU, agriculture, forestry/LULUCF, waste/waste management). However, the ERT noted that, in CTF table 6, the Party reported GHG projections on a sectoral basis, which corresponds with the sectoral categories used in the PaMs section. During the review Luxembourg explained that the description in the BR is an editorial decision, which was intended to reflect the information recorded in GHG inventories and the quality of methods used to make the projections, while also meeting the concerns of policymakers who need to know more about the overall emissions from industries other than the separate emissions from fuel combustion and industrial processes. The ERT recommends that the Party increase reporting transparency by presenting projections in the next BR on a sectoral basis, to the extent possible, using the same sectoral categories as used in the PaMs section.
4	Reporting requirement specified in paragraph 43	The Party reported in its BR4 information on the models used to project GHG emissions from the energy sector (including emissions from the subsectors of power and heat generation, road transportation, residential/commercial and

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
	Issue type: transparency Assessment: encouragement	international aviation) and also provided general information on non-modelling methods for the projections of the remaining sectors. However, the ERT noted that (1) the information on projections for the agriculture sector is insufficient because it mentioned only that new projections are provided by the Department for Rural Economy and (2) the assumptions provided on waste landfilling for the WEM and WAM projections are inconsistently presented in the report (e.g. the BR text on p.187 states that no distinction was made between a 'business as usual' (WEM) and a WAM section, whereas the footnote on the same page indicates "this is actually not totally true"). During the review Luxembourg provided the additional information on new projections for the agriculture sector, indicating that the EU PRIMES and GAINS models once used to project agricultural emissions are no longer used because they are not suitable for a small country. Instead, a new non-modelling method was used for the BR4, and additional improvements are planned for subsequent submissions. The Party also clarified that the new assumption on waste landfilling is included in BR4 table IV.3-1 ("MECDD hypothesis"). The ERT encourages the Party to increase reporting transparency by providing more detailed information on the methods used for agricultural emission projections and ensure consistency in the description of the assumptions used for the waste sector projections in the different scenarios.
5	Reporting requirement specified in paragraph 45 Issue type: transparency Assessment: encouragement	The ERT noted that the Party did not report on the main differences in the methods employed and the results between projections in the BR4 and NC7/BR3. During the review Luxembourg provided more information on changes in methods employed for the energy and agriculture sectors, as well as the application of new activity data projections derived from the National Air Pollution Control Programme in selected categories. The Party explained that in the energy sector a new model, the ISI-DELUX energy demand model, was used in the framework of the elaboration of Luxembourg's NECP instead of Econotec, STATEC-NEAM and Komobile. The Party also explained that the projections are based on a combination of sources and the Party plans to improve the harmonization of the projections in 2021–2022. Regarding the changes to the results of the projections, the Party explained that new projections had been prepared for common reporting format categories 1.A, 1.B, 2.D, 3, 5.B, and IB-Aviation and these revised projections explain the large differences observed, especially where one source has been replaced or where new developments have been considered. The Party also confirmed that in future, a comparison table explaining the differences would be provided. The ERT encourages the Party to include in its next BR information on the main differences in the assumptions made, methods employed and results obtained between projections in the current BR and those in earlier BRs.
6	Reporting requirement specified in paragraph 46 Issue type: transparency Assessment: encouragement	The ERT noted that the Party did not report sensitivity analyses for the projections in its BR4. Instead, the Party provided a general qualitative assessment of the level of uncertainty of the projections by major emissions source categories. The Party also briefly presented information on planned improvements and considerations in order to proceed with a sound sensitivity analysis in future. During the review Luxembourg explained further that, with the support of new human resources at both MECDD and STATEC, it is intending to put in place a more robust system for evaluating PaMs and estimating projected GHG emissions in 2021–2022. The ERT encourages the Party to improve the transparency of its reporting by discussing the sensitivity of the projection scenarios quantitatively, where possible, in its next BR.

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
7	Reporting requirement specified in paragraph 47 Issue type: transparency Assessment: encouragement	The Party did not include information on its fuel tax in CTF table 5. The ERT noted that CTF table 5 should include all relevant variables and parameters used in developing the projections scenarios. During the review Luxembourg clarified that a change in fuel taxation was considered by a consortium of research institutes in an ISI-DELUX modelling exercise when preparing energy scenarios for the NECP. The ERT encourages the Party to increase the transparency of its reporting by providing information on all key underlying assumptions and values of variables used for projections including, for example, fuel tax levels.
8	Reporting requirement specified in paragraph 48 Issue type: completeness Assessment: recommendation	The Party did not report relevant information on factors and activities for the LULUCF and waste sectors in CTF table 5 in its BR4. During the review Luxembourg explained that, because the waste sector represents less than 1 per cent of the total emissions (excluding LULUCF), and as most of the assumptions for activity data and factors are based on simple methods, expert judgment or political choice assumptions, the Party hesitated to publish them in a table; this is also the case for the LULUCF sector. The Party also clarified that, as LULUCF becomes more important in achieving the 2030 targets under the Paris Agreement, more work is expected to be done in this sector. The ERT recommends that the Party improve the completeness of its reporting by presenting relevant information on factors and activities also for the LULUCF and waste sectors in CTF table 5 in its next BR so as to enable the reader to understand the projected emission trends.

Note: Item listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs, as per para. 11 of the UNFCCC reporting guidelines on BRs. The reporting on the requirements not included in this table is considered to be complete, transparent and thus adhering to the UNFCCC reporting guidelines on NCs and on BRs.

D. Provision of financial, technological and capacity-building support to developing country Parties

1. Technical assessment of the reported information

(a) Approach and methodologies used to track support provided to non-Annex I Parties

72. In its BR4 Luxembourg reported information on its provision of financial, technological and capacity-building support to non-Annex I Parties.

73. Luxembourg has provided support that it considers to be “new and additional”. Its definition of “new and additional” is that support provided does not replace earlier commitments and is additional to its existing ODA commitments. Luxembourg has determined resources under its ICF programme to be “new and additional” where ICF funding is additional to its objective of allocating 1.0 per cent of gross national income to ODA. During the review, the Party clarified that in its BR4 all ICF activities are reported as other official flows to distinguish these from its reported climate-related ODA, and that the financial instrument of these flows is concessional grants.

74. Luxembourg reported the support that it has provided to non-Annex I Parties, distinguishing between support for mitigation and adaptation activities and recognizing the capacity-building elements of such support. It explained how it tracks finance for adaptation and mitigation using the Rio markers, noting that it has mainstreamed the use of the Rio markers in all its ODA projects and programmes through the use of an “Aid to Environment” marker, in addition to the standard biodiversity, desertification, mitigation and adaptation markers.

75. In its BR4 Luxembourg provided limited information on its national approach to tracking the provision of support, including information on indicators, delivery mechanisms used and allocation channels tracked. The Party’s approach is based on using the OECD DAC Rio markers, in particular the mitigation and adaptation markers, to identify programmes and

projects targeting climate change objectives. Although Luxembourg confirmed that there have been no changes to its national approach to tracking, since the BR3/NC7 it has added reporting on technological and capacity-building support in CTF tables 8 and 9.

76. During the review, Luxembourg provided details on its methodology and underlying assumptions used for collecting and reporting information on financial support, as set out in its 2016 report on the allocation of funds for international climate change financing. This methodology includes assessing projects on a case-by-case basis against eligibility criteria, identifying climate-related projects using the OECD DAC Rio markers, considering the multilateral development banks' approach to monitoring climate finance, and excluding from consideration any activities included on the "negative list" (such as new coal-fired power plants and nuclear projects). The Party clarified that its current approach is to quantify and report 100 per cent of funds where projects are identified as targeting climate change as either a "principal" or a "significant" objective (i.e. Rio marker 2 or 1).

77. During the review, the Party elaborated on the challenges it faces when reporting on support provided to non-Annex I Parties, in particular the challenges in quantifying public climate finance and reporting on mobilized private finance, given that only incomplete information is available. The Party noted the work that LuxDev is undertaking to improve the transparency of financial reporting, including through developing a new national integrated data management and monitoring system for improved reporting of activities financed through ODA and the Climate and Energy Fund. This work is expected to allow for greater quantitative information and could support future reporting on the provision of public climate finance.

(b) Financial resources

78. Luxembourg reported information on its provision of financial support to non-Annex I Parties as required under the Convention, including on financial support provided, committed and pledged, allocation channels and annual contributions. In its BR4 Luxembourg provided supplementary reporting to clarify differences and provide transparency between committed and disbursed funds, to avoid double counting of financial support in a given year, such as by providing additional information for CTF tables 7, 7(a) and 7(b) to reflect disbursements only, and 'net commitments' only, which are defined as committed amounts only reported when funding has not been disbursed in a given year. It also provided footnotes giving specific commitment and disbursement information by reported activity.

79. Luxembourg allocates its resources to address the adaptation and mitigation needs of non-Annex I Parties by taking a partnership approach with both public authorities and civil society, achieved through the ownership of the programmes and projects by beneficiaries (public authorities and civil society), a focus on results, inclusive partnerships, and transparency and mutual accountability. The Party noted the importance of providing untied aid and predictable, multi-year funding, while aligning with the priorities and development strategies of the partners involved. During the review, it provided further details in the context of its ICF programme, including how country needs described in project proposals are considered as part of the selection criteria of projects, on the basis of alignment with partner countries' nationally determined contributions, nationally appropriate mitigation actions, national adaptation plans and national adaptation programmes of action.

80. The Party described how its ICF assists non-Annex I Parties in mitigating GHG emissions and adapting to the adverse effects of climate change and any economic and social consequences of response measures, and contributes to technology development and transfer and capacity-building related to mitigation and adaptation. During the review, Luxembourg provided details of its selection criteria for programmes such as climate change impact and sustainable development key performance indicators, including using a reporting matrix to capture indicators on effectiveness and monitoring.

81. With regard to the most recent financial contributions aimed at enhancing the implementation of the Convention by developing countries, Luxembourg allocated its bilateral climate finance through, in particular, its ICF Climate and Energy Fund, on the basis of themes and preferential sectors (including mitigation, with a focus on renewable energy,

energy efficiency, transport, waste management and agriculture; adaptation, with a focus on the least developed countries and small island developing States; and REDD+) and a balanced allocation (e.g. allocating 40 per cent of funds towards climate change adaptation, 40 per cent towards climate change mitigation and 20 per cent towards REDD+). Allocation also takes into account the needs of host and partner countries and focuses on a limited number of partner countries, using eligibility criteria (e.g. impact and efficiency, compliance with sustainable development, transforming potential, creation of an enabling environment for investments, national priority, political will, and needs of the beneficiaries) outlined in the 2017 strategy on the attribution of ICF funds in the fight against climate change. Table 12 summarizes the information reported by Luxembourg on its provision of financial support.

Table 12
Summary of information on provision of financial support by Luxembourg in 2017–2018
(Millions of United States dollars)

	Year of disbursement	
Allocation channel of public financial support	*2017*	*2018*
ODA	426.62	481.40
Climate-specific contributions through multilateral channels, including:	16.25	11.84
Green Climate Fund	5.42	5.90
Trust Fund for Supplementary Activities	–	0.05
Other multinational climate change funds	10.83	5.90
Financial institutions, including regional development banks	56.47	51.50
United Nations bodies	7.38	19.98
Climate-specific contributions through bilateral, regional and other channels	31.42	45.89

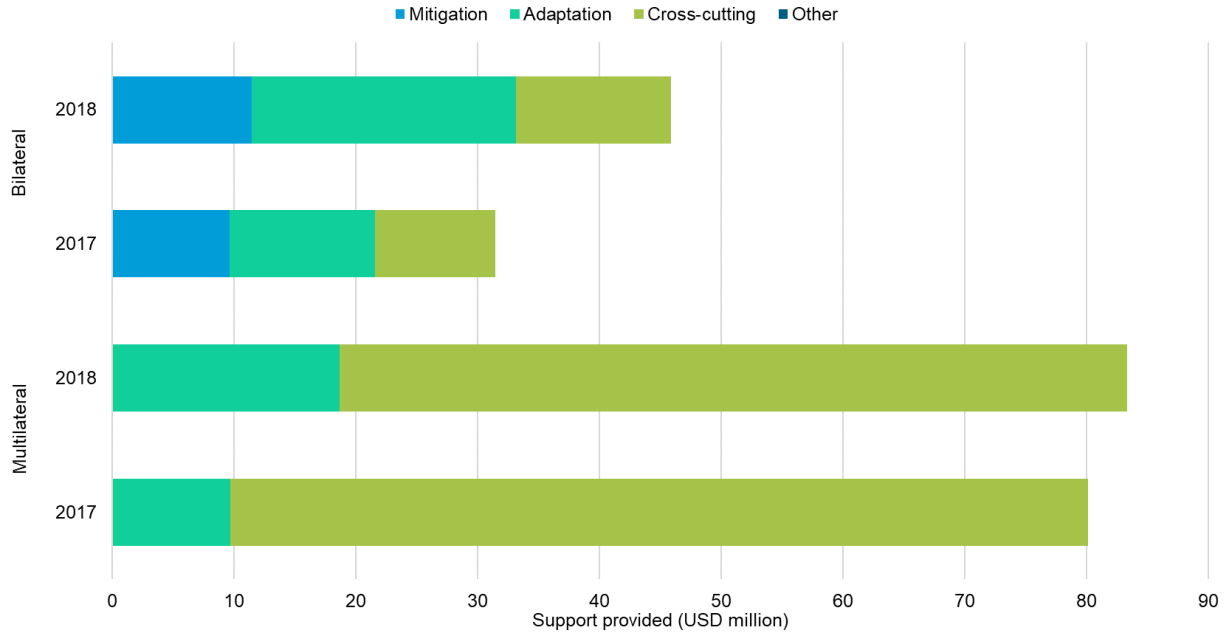
Sources: BR4 CTF tables and Query Wizard for International Development Statistics, available at http://stats.oecd.org/qwids/.

82. Luxembourg's climate-specific public financial support[7] totalled USD 111.52 million in 2017 and 129.22 million in 2018. It has increased its contributions by 36.9 per cent since the BR3 (2015–2016), as reported in its local currency. With regard to future financial pledges aimed at enhancing the implementation of the Convention by developing countries, Luxembourg has committed to providing a total of EUR 200 million between 2021 and 2025 through its ICF programme, including a contribution of EUR 40 million to the Green Climate Fund for 2020–2024. Luxembourg's provision of financial support through bilateral and multilateral channels has increased steadily from the fast-start finance period and notably through its ICF, and its transparency has improved on the status of pledged and disbursed funds by project in its BR4.

83. During the reporting period, Luxembourg placed a particular focus on the least developed countries in West Africa that receive a high share of its total climate-related ODA (Burkina Faso, Lao People's Democratic Republic, Mali, Niger and Senegal) as well as the small island developing State Cabo Verde. The ERT noted that Luxembourg reported in CTF table 7(b) its bilateral support allocated to Annex I Parties in 2017 and 2018. Information on financial support from the public sector provided through multilateral and bilateral channels and the allocation of that support by target area is presented in figure 3 and table 13. Note that variances in contribution amounts from year to year can occur that are not reflective of trends owing to factors such as the biennial or triennial contribution cycles of some multilateral funds, timing of approval of individual bilateral projects or changes in exchange rates.

[7] For the remainder of this chapter, the term "financial support" means climate-specific financial support, unless otherwise noted.

Figure 3
Provision of financial support by Luxembourg in 2017–2018



Source: Luxembourg's BR4 CTF tables 7, 7(a) and 7(b).

Table 13
Summary of information on channels of financial support used in 2017–2018 by Luxembourg
(Millions of United States dollars)

	Year of disbursement				*Share (%)*	
Allocation channel of public financial support	*2017*	*2018*	*Difference*	*Change (%)*	*2017*	*2018*
Detailed information by type of channel						
Multilateral channels						
Mitigation	0.06	–	–	–	0.1	–
Adaptation	9.64	18.66	9.02	93.5	12.0	22.4
Cross-cutting	70.40	64.66	–5.74	–8.1	87.9	77.6
Other	–	–	–	–	–	–
Total multilateral	**80.10**	**83.32**	**3.22**	**4.0**	**100.0**	**100.0**
Bilateral channels						
Mitigation	9.63	11.46	1.83	19.0	30.7	25.0
Adaptation	11.91	21.67	9.76	82.0	37.9	47.2
Cross-cutting	9.88	12.76	2.88	29.2	31.4	27.8
Other	–	–	–	–	–	–
Total bilateral	**31.42**	**45.89**	**14.48**	**46.1**	**100.0**	**100.0**
Total multilateral and bilateral	**111.52**	**129.22**	**17.70**	**15.9**	**100.0**	**100.0**

Source: Luxembourg's BR4 CTF tables 7, 7(a) and 7(b).

84. Luxembourg contributed through multilateral channels USD 80.10 million and 83.32 million for 2017 and 2018, respectively. The contributions were made to specialized multilateral climate change funds, such as the Green Climate Fund. The Party also reported that financial support provided through other multinational climate change funds and financial institutions, including regional development banks, increased significantly in its BR4 compared with the BR3, such that in 2017–2018 over 70 per cent of total public financial support for climate change was allocated through multilateral channels, the majority of which went to cross-cutting activities.

85. The Party reported detailed information on the total financial support provided through bilateral and regional channels, amounting to USD 31.42 million in 2017 and 45.89 million in 2018, respectively.

86. The BR4 provides information on the types of support provided. In terms of the focus of public financial support, as reported in CTF table 7 for 2017, the shares of the total public financial support allocated for mitigation, adaptation and cross-cutting projects were 8.7, 19.3 and 72.0 per cent, respectively. In 2018, the shares of total public financial support allocated for mitigation, adaptation and cross-cutting projects were 8.9, 31.2 and 59.9 per cent, respectively. The majority of support is allocated to cross-cutting projects, such as sustainable finance initiatives and activities for the promotion of human rights in the context of climate change.

87. The ERT noted that in 2017–2018 the majority of financial contributions through multilateral channels were allocated to the energy, agriculture, forestry and cross-cutting sectors, as reported in CTF table 7(a). In 2017 and 2018 the majority of financial contributions through bilateral and regional channels were allocated to the energy, agriculture, forestry, water and sanitation, and waste management sectors, as reported in CTF table 7(b).

88. CTF tables 7(a) and 7(b) include information on the types of financial instrument used for providing assistance to developing countries. For Luxembourg, all bilateral public financial support is delivered through grants, as is done with its ODA, while some multilateral support is provided through other channels, including a support programme for attracting private sector investment through 'first loss' guarantees.

89. The Party reported in its BR4 on its Climate Finance Task Force, which was established in 2015 to advise the Government on ways to establish Luxembourg as an international centre for climate finance, through raising awareness across the private sector of both the challenges of climate finance and the economic opportunities. In addition, the Party outlined a number of examples of successful projects, including the LuxFlag climate finance label and Luxembourg Green Exchange (establishing the world's first 'green platform'), and partnerships with the European Investment Bank and the United Nations Environment Programme to support green finance instruments such as green bonds and microfinance. Luxembourg also included examples of how it uses public funds to promote private sector financial support for developing countries to increase mitigation and adaptation efforts in developing countries (see para. 90 below). In the BR4, the Party explained that quantified reporting of mobilized private climate finance is not possible at this stage, and provided details on the challenges of reporting, including incomplete information available and the challenges for Luxembourg as an international finance centre.

90. An example of Luxembourg's provision of support is the Luxembourg–European Investment Bank Climate Finance Platform, delivered via the European Investment Bank with the objective of financing innovative investment in climate change projects, including leveraging the private sector by reducing financial risk, both within and outside the EU. Luxembourg has provided EUR 30 million for 2017–2019, with additional funding of EUR 40 million pledged for future years.

91. The Party also reported on the project "Enhancing resilience to climate change through solar power-driven access to water in rural areas of Outer Islands, Vanuatu", and provided further details during the review. The project focuses on the deployment of solar water-pumping units, by setting up guidelines and strengthening the capacity of institutions, including creating an enabling environment for implementing the recipient's mitigation targets under its nationally determined contribution and the national adaptation programme of action (mainstreaming disaster risk reduction), and aligning with the national energy road map and the national sustainable development plan.

(c) Technology development and transfer

92. Luxembourg provided information on the steps, measures and activities related to technology transfer, access and deployment benefiting developing countries, including on activities undertaken by the public and private sectors. Luxembourg provided examples of support provided for the deployment and enhancement of the endogenous capacities and technologies of non-Annex I Parties. One example of such support provided is the partnership

between the Cabo Verde Centre for Renewable Energy and Industrial Maintenance and the Competence Centre (Technical Engineering) at the University of Luxembourg. With this alliance, a renewable energy transition is facilitated through training and consulting services in engineering, energy efficiency and renewable energy.

93. The ERT took note of the information provided in the BR4 on publicly funded activities in the field of technology transfer, as well as on how Luxembourg encourages private sector activities. Technology transfer is focused on renewable energy technology and agriculture. One example provided in the BR4 is Luxembourg's provision of support to the Business Partnership Facility, a financing entity that encourages private sector engagement with partners in developing countries to implement sustainable business projects. Through co-financing private sector initiatives, the Facility contributes to broader economic development and job creation, specifically targeting projects in the areas of bio-health, information and communication technologies, and eco-innovation and the circular economy. The ERT noted that, owing to limited examples, it was not possible to identify geographical priorities or trends.

94. Another example of Luxembourg's efforts to encourage technology transfer is its provision of support to multilateral initiatives such as ADA, which provides capacity-building in the form of support and training on microfinance and digital finance (including digital financial services) to urban and rural micro- and small entrepreneurs and agricultural producers in the least developed countries.

(d) Capacity-building

95. Luxembourg has provided capacity-building support for mitigation, adaptation and technology that responds to the existing and emerging needs identified by non-Annex I Parties. It described individual measures and activities related to capacity-building support in textual and tabular format. In its BR4, Luxembourg noted that it strives to support organizations that promote endogenous capacities, including farmer organizations that work to provide training and awareness-raising such as Third World Solidarity Action and the Agro-ecological Research and Training Association.

96. Luxembourg has supported climate-related capacity development activities relating to adaptation, mitigation, climate financing and technology development and transfer, as well as educational activities. The Party reported no change in its approach since the BR3. Luxembourg's support has responded to the existing and emerging capacity-building needs of non-Annex I Parties by following the principles of national ownership and partnership, and reflecting country needs. Information was provided during the review on its approach to identifying and focusing on country needs in its project selection criteria, as described in paragraphs 79–81 above.

97. The Party highlighted in its BR4 many examples of capacity-building support. Successful projects include a project in Burkina Faso supporting the sustainable management of forest resources that, through Luxembourg's Forest Sector Support Programme, provides capacity-building to develop tools for country planning and for steering and monitoring its programmes; and the "Brava – sustainable island" project in Cabo Verde supporting the country's need for drinking water through the deployment of solar water-pumping desalination units. The BR4 reports that a pumping capacity of 300 m^3 per day has been provided by solar-powered desalination units. During the review, the Party outlined how the project in Cabo Verde is benefiting from very good collaboration and transfer of know-how and technologies. A training centre on renewable energies is operational and has been successful in creating jobs and training young people in renewable energies, in collaboration with a skills centre in Luxembourg.

2. Assessment of adherence to the reporting guidelines

98. The ERT assessed the information reported in the BR4 of Luxembourg and identified issues relating to completeness and transparency and thus adherence to the UNFCCC reporting guidelines on BRs. The findings are described in table 14.

Table 14
Findings on provision of support to developing country Parties from the review of the fourth biennial report of Luxembourg

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement specified in paragraph 14 Issue type: completeness Assessment: recommendation	The Party reported information on the provision of financial, technological and capacity-building support to non-Annex I Parties in its BR4, including on delivery mechanisms and allocation channels, and provided supplementary information to clarify differences between commitments and disbursements to avoid double counting. However, the Party provided only a general description of its national approach for tracking the provision of financial, technological or capacity-building support to non-Annex I Parties in its BR4, based on mainstreaming the use of the Rio markers. During the review Luxembourg provided comprehensive information on its current approach, methodology and assumptions for reporting financial support (see para. 76 above). The ERT reiterates the recommendation from the previous review report for Luxembourg to increase the completeness of its reporting by providing in its next BR a description of the national approach to tracking the financial, technological and capacity-building support provided to non-Annex I Parties.
2	Reporting requirement specified in paragraph 16 Issue type: completeness Assessment: recommendation	In its BR4 Luxembourg did not report on how its development cooperation effectively addresses the needs of non-Annex I Parties, and how these needs are assessed. During the review Luxembourg provided information on its approach to assessing needs, including detailed selection criteria, project proposal templates and a reporting matrix on indicators to assess effectiveness and assist project monitoring (see para. 79 above). The ERT recommends that the Party improve the completeness of its reporting by providing, to the extent possible, information on how it seeks to ensure that the resources it provides effectively address the needs of non-Annex I Parties, including on how the needs and the effectiveness of support are assessed.
3	Reporting requirement specified in paragraph 19 Issue type: completeness Assessment: encouragement	Luxembourg did not report on private financial flows leveraged by bilateral climate finance towards mitigation and adaptation activities in non-Annex I Parties. In the BR4, and during the review, the Party explained that quantified reporting of mobilized private climate finance is not possible at this stage, and provided details on the challenges of reporting, including that only incomplete information is available. The ERT reiterates the encouragement from the previous review report for the Party to increase the completeness of its reporting by providing in its next BR, to the extent possible, information on private financial flows leveraged by bilateral climate finance towards mitigation and adaptation activities in non-Annex I Parties.
4	Reporting requirement specified in paragraph 23 Issue type: completeness Assessment: recommendation	The Party highlighted many examples of its provision of capacity-building support in its BR4, and outlined the importance of country needs in its development cooperation strategy. However, in its BR4, the Party did not report on how it assesses whether its support responds to the existing and emerging capacity-building needs of non-Annex I Parties. During the review Luxembourg provided comprehensive information on how country needs are identified and considered in its selection criteria for projects. For example, Luxembourg indicated that applicants for support must include capacity-building needs in their project proposals, as this is considered as one of the selection criteria. The Party also provided the detailed template applicants are required to complete, including all details and explanations needed to assess the eligibility of the project, and the proposed indicators to be used in the monitoring and reporting on the project's implementation. Finally, the Party elaborated on the review of the proposals to ensure that they meet the selection criteria, but noted that, owing to capacity constraints within Luxembourg, the internal reporting matrix is not always up to date.

No.	Reporting requirement, issue type and assessment	Description of the finding with recommendation or encouragement
		The ERT recommends that, to improve the completeness of its reporting, Luxembourg include 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 non-Annex I Parties in the areas of mitigation, adaptation, and technology development and transfer in its next BR.

Note: Item listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on BRs. The reporting on the requirements not included in this table is considered to be complete, transparent and thus adhering to the UNFCCC reporting guidelines on BRs.

III. Conclusions and recommendations

99. The ERT conducted a technical review of the information reported in the BR4 and BR4 CTF tables of Luxembourg in accordance with the UNFCCC reporting guidelines on BRs. The ERT concludes that the reported information mostly adheres to the UNFCCC reporting guidelines on BRs and provides an overview of emissions and removals related to the Party's quantified economy-wide emission reduction target; assumptions, conditions and methodologies related to the attainment of the target; the progress of Luxembourg towards achieving its target; and the Party's provision of support to developing country Parties.

100. Luxembourg's total GHG emissions excluding LULUCF covered by its quantified economy-wide emission reduction target were estimated to be 17.2 per cent below its 1990 level, whereas total GHG emissions including LULUCF were 19.5 per cent below its 1990 level, in 2018. Emissions peaked in 1991 and dropped substantially until 1998, returning to levels near 1990 by 2012 before falling steadily until 2015. From 2016 onward, emissions increased slightly. The changes in total emissions over 1990–2018 were driven mainly by factors such as a change in the energy mix (liquid fuels and biofuels have replaced solid fuels), structural changes in the energy and industrial sectors, and increased fuel consumption from road transportation.

101. Under the Convention Luxembourg committed to contributing to the achievement of the joint EU quantified economy-wide target of a 20 per cent reduction in emissions below the 1990 level by 2020. The target covers all sectors and CO_2, CH_4, N_2O, HFCs and SF_6 (not PFCs), expressed using GWP values from the AR4. Emissions and removals from the LULUCF sector are not included.

102. Under the ESD Luxembourg has a target of reducing its emissions by 20 per cent below the 2005 level by 2020. The 2013–2020 progression in Luxembourg's AEAs (its national emission target under the ESD) is 8,116.94 Gg CO_2 eq.

103. In addition to its ESD target, Luxembourg committed to achieving a 2030 target of a 55 per cent reduction in emissions below the 2005 level by 2030 as part of the ESR. As part of its NECP, Luxembourg further committed to achieving a 25 per cent share of primary energy consumption for renewable energy sources by 2030, and a 40–44 per cent improvement in energy efficiency by 2030 compared with the 2007 level. These commitments are enshrined in Luxembourg's 2020 Climate Protection Law. Luxembourg has not yet developed its long-term low GHG emission development strategy, as required under the Paris Agreement. In the BR4, Luxembourg indicated that it is currently working to develop the strategy, and to identify the main fields of action and the strategic measures needed to reach climate neutrality by 2050.

104. In 2018 Luxembourg's ESD emissions were 6.4 per cent (544.64 kt CO_2 eq) above the AEA. While the Party has used market-based units in the past (2010–2012), the ERT noted that in 2018 the use of market-based mechanisms accounted for 0.00 kt CO_2 eq. With respect to its AEAs, Luxembourg has a cumulative surplus of 1,056.80 kt CO_2 eq, which would be sufficient to cover the existing gap between emissions and AEAs for 2018.

105. The GHG emission projections provided by Luxembourg in its BR4 correspond to the WEM and WAM scenarios. Under these scenarios, emissions are projected to be 25.6 and 29.0 per cent below the 1990 level by 2020, respectively. According to the projections under the WEM scenario, ESD emissions are estimated to reach 8,087.07 kt CO_2 eq by 2020. Under

the WAM scenario, Luxembourg's ESD emissions in 2020 are projected to be 7,669.92 kt CO_2 eq. The projected level of emissions under the WEM and WAM scenarios is 0.4 and 5.5 per cent, respectively, below the AEAs for 2020. The ERT noted that the Party's cumulative surplus of AEAs is 1,056.80 kt CO_2 eq, which suggests that Luxembourg expects to meet its target under both the WEM and WAM scenarios.

106. Luxembourg's main policy framework relating to energy and climate change is its 2013 second Action Plan for Reducing CO_2 Emissions. The Party described the mitigation actions that it has implemented to help it achieve its 2020 targets. The key overarching cross-sectoral policy reported by Luxembourg concerns the diversification of its economy and the use of public funds for promoting eco-technologies. The aim of the policy is to make better use of public financial support for eco-technological research and development projects, as well as to support businesses and sectors in collaborating and working in a cross-sectoral manner in a 'clean technology' cluster. In addition, the Third Industrial Revolution Strategy Study provides the framework for future climate policies and for Luxembourg to meet its emission reduction target for 2020. The study is a joint process, bringing together a number of stakeholders to exchange ideas and tools for the transition to a new economic model defined by the coupling of information technologies, renewable energy sources and intelligent transport networks.

107. The Party highlighted the mitigation actions for 2020–2030 that it has recently implemented and plans to implement to help achieve its medium- and long-term emission reduction targets. These PaMs include improved energy efficiency standards (heating and hot water) for residential buildings and for non-residential new and existing buildings. The National Renewable Energy Action Plan provides detailed road maps for how Luxembourg expects to reach its 2020 target for the share of renewable energy in its final energy consumption. Luxembourg has also established feed-in tariffs to promote the use of renewable sources (waste wood, pellets and sewage gas) for the production of electricity and heat, and also to promote the use of biogas as a substitute for natural gas.

108. Luxembourg continues to provide climate financing to developing countries in line with its climate finance programmes such as its ICF programme. It has increased its contributions by 36.9 per cent since the BR3; its public financial support in 2017 and 2018 totalled USD 111.52 million and 129.22 million, respectively. For those years, Luxembourg provided more support for adaptation than for mitigation. The biggest share of financial support went to projects and programmes in the energy sector, followed by projects and programmes in the agriculture sector. An example of this support is the collaboration with the European Investment Bank on the Climate Finance Platform, to which Luxembourg provided EUR 30 million for 2017–2019, with a pledge of EUR 40 million for future years. While the vast majority of funds (about 90 per cent) are used to support actions within the EU member States, the remainder supports projects in sub-Saharan Africa, the Caribbean, the Pacific, Asia and Latin America. The Climate Finance Platform aims to provide innovative investment in climate change projects, including leveraging private sector support by reducing financial risk.

109. Luxembourg continues to provide support for technology development and transfer and capacity-building. Priority for technological support was given to projects and programmes involving renewable energy technologies and agriculture. A key programme is the partnership between the Cabo Verde Centre for Renewable Energy and Industrial Maintenance and the Competence Centre (Technical Engineering) at the University of Luxembourg, the aim of which to facilitate the transition to renewable energy through training and consulting services in engineering, energy efficiency and renewable energy.

110. Priority for capacity-building support was given to projects and programmes in the forestry sector and natural resource management in the least developed countries. Since the BR3, the focus has remained the same. A good example of the Party's support for capacity-building is its support provided to the "Brava – sustainable island" project in Cabo Verde. The aim of this project is to enhance access to drinking water through installing solar water-pumping units and strengthening the capacity of the implementing institutions. The project has demonstrated successful collaboration and transfer of knowledge and technologies in renewable energies, and has generated a legacy of job creation and youth training.

111. In the course of the review, the ERT formulated the following recommendations for Luxembourg to improve its adherence to the UNFCCC reporting guidelines on BRs in its next BR:

(a) To improve the completeness of its reporting by:

(i) Providing relevant information on factors and activities for all sectors in CTF table 5 in its next BR so as to enable the reader to understand the projected emission trends (see issue 8 in table 11);

(ii) Providing a description of the national approach to tracking the financial, technological and capacity-building support provided to non-Annex I Parties (see issue 1 in table 14);

(iii) Providing information, to the extent possible, on how it seeks to ensure that the resources it provides effectively address the needs of non-Annex I Parties, including on how the needs and the effectiveness of support are assessed (see issue 2 in table 14);

(iv) Providing 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 non-Annex I Parties (see issue 4 in table 14);

(b) To improve the transparency of its reporting by:

(i) When reporting on its quantified economy-wide emission target, providing consistent references to the sectors included in the target and completing all the empty cells in the CTF tables (see issue 1 in table 3);

(ii) Providing consistent information in the BR and CTF tables with regard to PaMs, using notation keys and custom footnotes, as necessary (see issue 1 in table 5);

(iii) Providing the estimated effect of each mitigation action, or providing a clear explanation in the text of the BR as to why this is not possible owing to national circumstances and reporting consistent information on PaMs in the BR and in CTF table 3 (see issue 2 in table 5);

(iv) Explaining which sectors are excluded from its target for 2020 (see issue 1 in table 7);

(v) Including all planned PaMs in the WAM scenario and ensuring consistency between the planned PaMs reported in the PaMs section and the projections under the WAM scenario (see issue 2 in table 11);

(vi) Providing projections on a sectoral basis, to the extent possible, using the same sectoral categories as used in the PaMs section (see issue 3 in table 11);

(c) To improve the timeliness of its reporting by submitting its next BR on time (see para. 6 above).

Annex

Documents and information used during the review

A. Reference documents

2020 GHG inventory submission of Luxembourg. Available at https://unfccc.int/documents/228020.

BR3 of Luxembourg. Available at https://unfccc.int/documents/64774.

BR4 of the EU. Available at https://unfccc.int/BRs.

BR4 of Luxembourg. Available at https://unfccc.int/BRs.

BR4 CTF tables of Luxembourg. Available at https://unfccc.int/BRs.

"Common tabular format for 'UNFCCC biennial reporting guidelines for developed country Parties'". Annex to decision 19/CP.18. Available at https://unfccc.int/resource/docs/2012/cop18/eng/08a03.pdf.

"Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention". FCCC/SBSTA/2014/INF.6. Available at http://unfccc.int/resource/docs/2014/sbsta/eng/inf06.pdf.

European Green Deal. Available at https://ec.europa.eu/info/files/communication-european-green-deal_en.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories". Annex to decision 24/CP.19. Available at http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications". FCCC/CP/1999/7. Available at http://unfccc.int/resource/docs/cop5/07.pdf.

"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention". Annex to decision 13/CP.20. Available at http://unfccc.int/resource/docs/2014/cop20/eng/10a03.pdf.

NECP of Luxembourg (Summary). Available at https://ec.europa.eu/energy/sites/ener/files/documents/necp_factsheet_lu_final.pdf.

Report on the technical review of the BR3 of Luxembourg. FCCC/TRR.3/LUX. Available at https://unfccc.int/documents/193745.

"UNFCCC biennial reporting guidelines for developed country Parties". Annex I to decision 2/CP.17. Available at http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf.

B. Additional information provided by the Party

Responses to questions during the review were received from Eric De Brabanter (MECDD), including additional material. The following documents[1] were provided by Luxembourg:

Luxembourg. 26 October 2020. *NEC und THG Prognosen (in German)*. Not available online.

Luxembourg. 2020. *Ammoniac and GHG projections (in German, with English translation)*. Not available online.

[1] References reproduced as received from the Party.

Luxembourg. 2020. Ministry of the Environment, Climate and Sustainable Development *Data for projection for BR4.* Not available online.

Luxembourg. November 2019. International Climate Finance Programme (ICF). *General Submission Template for ICF Funding.* Not available online.

Luxembourg. 11 December 2018. *Plan national integre en matiere d'energie et de climat du Luxembourg pour la periode 2021–2030 (in French).* Not available online.

Luxembourg. 11 December 2018. *Integrierter Nationaler Energie- und Klimaplan Luxemburgs fur den Zeitraum 2021–2030 (in German)*. Not available online.

Luxembourg. 7 November 2016. Ministry of Sustainable Development and Infrastructure Department of the Environment. *Allocation of funds for international climate change financing.* Available at https://environnement.public.lu/dam-assets/fr/actualites/2017/05/22_financement_climatique/fci_strategie.pdf.

Luxembourg. 2012. Submission to the UN Convention on long-range transboundary air pollutants. Not available online.