



Brussels, 18.12.2023
SWD(2023) 919 final

COMMISSION STAFF WORKING DOCUMENT

Assessment of the draft updated National Energy and Climate Plan of Luxembourg

Accompanying the document

COMMISSION RECOMMENDATION

on the draft updated integrated national energy and climate plan of Luxembourg covering the period 2021-2030 and on the consistency of Luxembourg's measures with the Union's climate-neutrality objective and with ensuring progress on adaptation

{C(2023) 9609 final}

Contents

| | | |
|-------|--|----|
| 1 | SUMMARY | 3 |
| 1.1 | Overview of key objectives, targets and contributions in the draft updated NECP 3 | |
| 1.2 | Summary of the main observations | 4 |
| 2 | PREPARATION AND SUBMISSION OF THE DRAFT UPDATED NECP | 7 |
| 2.1 | Process and structure | 7 |
| 2.2 | Public consultation..... | 8 |
| 2.3 | Regional consultations for preparing the draft updated NECP..... | 8 |
| 3 | ASSESSMENT OF THE AMBITION OF OBJECTIVES, TARGETS AND CONTRIBUTIONS AND ADEQUACY OF SUPPORTING POLICIES AND MEASURES | 9 |
| 3.1 | Decarbonisation dimension..... | 9 |
| 3.1.1 | <i>Greenhouse gas emissions, removals and storage</i> | 9 |
| 3.1.2 | <i>Adaptation</i> | 12 |
| 3.1.3 | <i>Renewable energy</i> | 12 |
| 3.2 | Energy efficiency (including buildings) dimension..... | 15 |
| 3.3 | Energy security dimension..... | 17 |
| 3.4 | Internal energy market dimension | 19 |
| 3.5 | Research, innovation, competitiveness and skills dimension..... | 20 |
| 3.5.1 | <i>Research and innovation</i> | 20 |
| 3.5.2 | <i>Competitiveness</i> | 21 |
| 3.5.3 | <i>Skills</i> | 21 |
| 4 | JUST TRANSITION..... | 21 |
| 5 | REGIONAL COOPERATION | 22 |
| 6 | INTERNAL COHERENCE AND POLICY INTERACTIONS WITHIN THE DRAFT UPDATED NECP..... | 22 |
| 7 | STRATEGIC ALIGNMENT WITH OTHER PLANNING INSTRUMENTS | 22 |
| 8 | FINANCING THE ENERGY AND CLIMATE TRANSITIONS..... | 24 |
| 8.1 | Investment needs..... | 24 |
| 8.2 | Funding sources | 24 |
| 9 | ROBUSTNESS OF THE ANALYTICAL BASIS OF THE DRAFT UPDATED NECP | 24 |

1 SUMMARY

1.1 Overview of key objectives, targets and contributions in the draft updated NECP

The European Green Deal, the fast-evolving geopolitical context and the energy crisis have led the EU and its Member States to accelerate the energy transition and set up more ambitious energy and climate objectives, including as regards diversification of energy supplies. These developments are reflected in the legislative framework adopted under both the Fit for 55 package and the REPowerEU plan.

Luxembourg’s draft updated national energy and climate plan (“the draft updated NECP” or “the plan”), submitted on 24 July 2023, partially takes into account this new geopolitical and legislative framework.

Table 1: Summary of key objectives, targets and contributions of Luxembourg’s draft updated NECP

| | | 2020 | Progress based on latest available data | 2030 national targets and contributions | Assessment of 2030 ambition level |
|---|---|--------------------------------|--|---|--|
|  | Binding target for greenhouse gas emissions compared to 2005 under the Effort Sharing Regulation (ESR) (%) | | 2021: -20.2% 2022: -30.0% ¹ | Target: -50% | NECP: -57.8% |
| | Binding target for net greenhouse gas removals under the Regulation on Land Use, Land Use Change and Forestry (LULUCF) | | Reported net removals of -0.61 Mt CO ₂ eq. in 2021 and reported approximated net removals of -0.75 Mt CO ₂ eq. in 2022 | -27 Kt CO ₂ eq. (additional removals target) -403 Kt CO ₂ eq. (total net removals) | The plan reflects the increased level of ambition for 2030 |
|  | National target/contribution for renewable energy: Share of energy from renewable sources in gross final consumption of energy (%) | 11.7%(SH ARES) 11% (target) | 11.7% | 37% | LU contribution of 37% is line with the 37% required pursuant the formula set out in Annex II of the Governance Regulation |
|  | National contribution for energy efficiency: | | | | |
| | Primary energy consumption | 45 00 ktoe | 4,187 ktoe | Not available | LU primary energy consumption |

¹ The ESR emissions for 2021 are based on final inventory data and for 2022 on approximated inventory data. However, the final ESR emissions for 2021 and 2022 will only be established in 2027 after a comprehensive review.

| | | | | | |
|---|--|-------------|------------|------------------|--|
| | | | | | contribution is not available. EED recast Annex I formula results: 2,821 ktoe |
| | Final energy consumption | 42, 40 ktoe | 4,062 ktoe | 3,046 ktoe | LU final energy consumption contribution is 3,046 ktoe. EED recast Annex I formula results: 2,712 ktoe |
|  | Level of electricity interconnectivity (%) | 55.2% | 168.4% | 15% ² | |

Source: Eurostat; Luxembourg's draft updated national energy and climate plan

1.2 Summary of the main observations³

Luxembourg's draft updated NECP embeds the revised energy and climate targets of the Fit for 55 legislative package and the REPowerEU plan and expects to deliver on them in full.

Regarding the **reduction of greenhouse gas emissions under the Effort Sharing Regulation (ESR)**, the plan provides emission projections to demonstrate that with the additional policies and measures put forward in the draft updated NECP, Luxembourg is on track to meet its national greenhouse gas target of -50% in 2030 compared to 2005 levels. According to Luxembourg's projections, they would overachieve the target by 7.8 percentage points. Policies and measures are properly described in terms of their scope, timing and expected impacts.

On **Land Use Land Use Change and Forestry (LULUCF)**⁴, the draft updated plan indicates that Luxembourg will meet, even slightly exceed, its 2030 target with additional measures. However, it also lacks information on the status and progress in ensuring higher tier levels and geographically explicit datasets needed to ensure the robustness of net removal estimates.

On **Carbon Capture Utilisation and Storage (CCUS)**, the plan does not identify annual CO₂ emissions that can be captured, nor geological CO₂ storage capacity. The plan states

² Calculated by the European Commission based on the ETNSO-E data (Winter Outlook 2022-2023). The 2030 level represents the general interconnectivity target of 15%. The level of ambition cannot be assessed, because the actual 2030 interconnectivity levels will depend on the implementation of the planned interconnectors and changes in the generation capacity.

³ In addition to the notified draft NECP, this assessment also considers informal bilateral exchanges, which are part of the iterative process established under the Governance Regulation.

⁴ Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (OJ L 156, 19.6.2018, p. 1).

that Luxembourg has inadequate geology and limited storage capacity. No details on CO₂ transport are provided.

The draft updated plan reflects partial progress towards **international commitments under the Paris Agreement**. While Luxembourg is already coal free in the electricity sector, there is very little information on the phasing out of fossil fuel subsidies.

Luxembourg has demonstrated an awareness of **climate vulnerabilities and risks** that could affect the achievement of national Energy Union objectives, targets, and contributions. It has formulated climate adaptation goals and has taken and is planning to take measures, which includes insurance policies, fiscal measures, nature restoration measures as well as nature-based solutions.

For **renewable energy**, the draft updated plan puts forward a contribution of 37% to the 2030 EU renewable energy target, of country's gross final energy consumption, which is in line with the share resulting from the formula in Annex II of the Regulation (EU) 2018/1999 on the Governance Regulation of the Energy Union and Climate Action ("Governance Regulation"). Overall, the draft updated plan includes indicative trajectories for renewables in the electricity, transport and heating and cooling sectors that reflects Directive (EU) 2018/2001 on the use of energy from renewable sources as amended by Directive (EU) 2023/2413 ("revised REDII"), but fails to include the share of renewable energy sources in industry and buildings. At the same time, the plan provides additional policies and measures to achieve the increased ambition, measures differ in maturity (envisioned plans vs full-fledged legislation).

As regards to **energy efficiency**, the draft Luxembourgish updated NECP is a very comprehensive, ambitious, informative, and detailed document. There are measures impacting energy efficiency throughout all the dimensions and the new ambition of the Directive (EU) 2023/1791 on energy efficiency and amending Regulation (EU) 2023/955⁵ ("EED recast") has been taken into account. The ambition of the national contribution to the 2030 EU energy efficiency target is higher compared to what was included in the final NECP 2020, but lower than the theoretical result of the Directive (EU) 2023/1791 on energy efficiency and amending Regulation (EU) 2023/955 ("EED recast") Annex I formula. No target in primary energy consumption ("PEC") has been provided for 2030.

In relation to **buildings**, the draft updated NECP is very comprehensive, and include key elements, targets and milestones of the 2020 long-term renovation strategy (LTRS). It is forward-looking and includes accompanying measures very much aligned with the proposed revision of the Directive 2010/31/EU on the energy performance of buildings ("EPBD") such as measures to facilitate the uptake of Minimum Energy Performance Standards (MEPS), phase out of fossil fuels and deployment of solar energy installations in buildings. The proposed policies and measures do not include individual quantification as regards Final Energy Consumption ("FEC"), Primary Energy Consumption ("PEC") and GHG impacts. The milestones for the renovation of buildings have not been extended beyond residential buildings.

On **energy security**, the draft updated plan aims to reduce dependency on energy imports. Given the high energy consumption of Luxembourg's industrial sector, however, the plan relies on a well-functioning European Internal Energy Market as a critical pre-condition to

⁵ OJ L231

national security of supply. Luxembourg aims to reduce its natural **gas** consumption by more than 40% by 2030, notably through electrification, energy efficiency and renewable thermal technologies. There are few details on the concrete measures to achieve this reduction within the foreseen timeframe. The draft updated plan also does not explain how the emergency measures for reducing gas demand adopted in the aftermath of the war in Ukraine are integrated in the mid-term planning towards 2030.

In the **electricity** sector, there is a lack of detail and no measurable target for the deployment of power storage. There are also few details on how to achieve the high electrification ambitions. In the **oil** sector, the draft update plan highlights the intention to lower dependence on oil products by decreasing oil consumption through carbon pricing, increasing the share of renewable energy sources and by establishing incentives to switch to electric cars and electric heating systems.

As for the internal market dimension, the draft updated plan stresses the objective to further increase the interconnection levels, already very high with total imports of 85% of the electricity consumption of Luxembourg. Regarding flexibility, Luxembourg is well advanced with a very important roll-out of smart meter. The close cooperation within the Pentalateral Group to promote key policies for flexibility and demand response is also welcome.

On **energy poverty**, the draft updated NECP outlines key indicators for the estimation of vulnerable household but does not include specific target for energy poverty, neither under the energy savings obligation. The draft updated plan tables a comprehensive policy response to address immediate needs with dedicated assistance and a minimum supply of domestic energy, targeted support and advice to vulnerable consumers. At the same time, the draft updated plan highlights measures to encourage long term improvement via structural measures on energy efficiency, refurbishment of buildings.

For the **research, innovation, competitiveness and skills dimension**, Luxembourg's draft updated NECP outlines some policies and measures as regards research and innovation (R&I) in energy and clean technologies but provides little quantitative information on future R&I targets, investments and trends towards 2030 and 2050. The plan does not provide information on the investments needed for the manufacturing of key components and equipment for net-zero technologies, and how Luxembourg will reinforce the resilience of its supply chains for clean technologies in case of lack of domestic production. The draft updated plan also lacks information related to the financing of upskilling and reskilling measures and the digitalisation of the energy system.

Just transition is partially addressed in the draft updated NECP. While there is information on some impacts on employment of the climate and energy transition, the plan lacks information on social and skills consequences, including distributional impacts. The plan elaborates on several policies and measures to tackle these issues and sets out a comprehensive set of measures and programmes to ensure affordability of energy, mitigate the impact of the energy transition on consumers through measures ensuring redistribution of revenues, financial support schemes for energy related measures as well as social support schemes. However, it is not clear which exact resources will be devoted to supporting the just transition. Finally, the plan does not provide sufficient information for the preparation of the Social Climate Plan and how the consistency of the two plans would be ensured.

Regarding the **strategic alignment with other planning instruments**, the draft updated NECP is partially consistent with the national Recovery and Resilience Plan (RRP) and its amendments. Luxembourg has not yet submitted its REPowerEU chapter. Synergies with reforms and investments in the RRP (also within the draft REPowerEU chapter) are not reflected in a consistent and granular manner. The Luxembourg draft updated NECP is aligned with the latest European Semester Country Specific Recommendations and reflects the challenges to be addressed by the country.

The assessment of the **investment needs** is based on a bottom-up methodology and a breakdown approach by sector, but not based on the five dimensions. The funding includes additional investments from private and public sources, but the plan does not identify the funding sources at the level of policies and measures, which prevents having a comprehensive overview.

The draft updated plan is based on solid **quantitative analysis**. Both ‘with existing measures’ (WEM) and ‘with additional measures’ (WAM) projections are delivered, including a detailed quantitative specification. Projections of the WAM scenario for 2050 suggest that the policies and measures of the draft updated NECP would already make it possible to nearly approach climate neutrality in 2050. The macro-economic assessment of the draft updated plan is not sufficiently developed.

2 PREPARATION AND SUBMISSION OF THE DRAFT UPDATED NECP

2.1 Process and structure

The draft updated plan was notified on 24 July 2023, and follows the structure in Annex I of the Governance Regulation, covering all five dimensions of the Energy Union, and including objectives, targets or contributions for each, backed by policies and measures and underpinned by an analytical basis, including an impact assessment.

The draft updated plan provides evidence that, in line with the “whole of Government approach”, Luxembourg reached out and worked together with all relevant authorities to update the draft plan, considering synergies and trade-offs across different portfolios. The platform for climate action and energy transition (Plateforme climat), created to establish a multilevel dialogue between local and national authorities, civil society organizations, professional chambers and employers' and employees' organizations, and other relevant stakeholders, like youth, was called upon to formulate an opinion relating to the preliminary draft update. The draft updated plan does not include a summary of this opinion.

The draft updated plan describes well the national context in which it was developed, with particular attention to the specificities of the Luxembourgish energy system dominated by large import shares one very dominant industrial electricity consumer, as well as very high emissions in the transport sector due to the significant sale of fuels to transit traffic. This is followed by a list of current policies and measures in climate and energy field.

Luxembourg has consulted local authorities and other stakeholders in the preparation of the NECP. Luxembourg has included in the policies and measures two voluntary initiatives targeting cities: (i) the Climate Pact on climate action on mitigation and adaptation to cities and (ii) the Nature Pact on protection of biodiversity. Several policies and measures include collaboration and cooperation between the national and local authorities. This includes

policies and measures in the domain of energy efficiency in buildings, sustainable mobility and electric vehicles, urban/public transport, urban planning, renewable energies and district systems, financing, and citizen information.

2.2 Public consultation

The public participation procedure outlined in the draft updated plan ensured early public participation before decisions were taken and throughout the decision-making process. A 30-day public consultation was carried out from 17 April to 16 May 2023, during which interested parties could express their views and consult relevant documents, including the preliminary draft update of the NECP. The public also had the possibility to submit comments via e-mail and post. A total of 42 contributions were identified, analysed, and considered by the government in preparing the update. Contributions led to changes to some of the measures in the preliminary draft, while others still require further analysis and exchange, and may still be reflected in the final updated plan. Comments on the implementation of measures will be considered during the implementation process, where appropriate, and in consultation with relevant stakeholders. However, the draft updated NECP does not contain a clear and detailed summary of how the public's views were considered and addressed, or why they were not.

In addition, Luxembourg also established a new initiative, “the Klima-Biergerrot” to raise awareness on energy and climate policies gathering a representative sample of the population. The report of this initiative has fed into the preparation of the draft updated plan and the institutional discussions. However, once again, the plan does not clearly state which views expressed in this forum have been integrated.

2.3 Regional consultations for preparing the draft updated NECP

There have been various consultations with neighbouring countries such as Belgium, France and Germany, and the Netherlands. These took place in established fora, including under the Pentalateral Energy Forum working by dimension. Moreover, Luxembourg has been taking part in the North Seas Energy Co-operation (NSEC), involving several Member States as well as Norway in the North Sea region. The text clearly outlines the structure, focus areas, and mechanisms through which regional cooperation is achieved in both initiatives. The process involves regular meetings, collaboration among stakeholders, sharing of knowledge, and coordination with international organizations to address challenges and promote the integration of renewable energy sources in the respective regions. The main outcome has been summarised in the draft updated NECP. The collaboration mainly focused on the following topics: energy security, decarbonisation and developing cross-border renewable energy projects, including offshore wind and related grid investments.

3 ASSESSMENT OF THE AMBITION OF OBJECTIVES, TARGETS AND CONTRIBUTIONS AND ADEQUACY OF SUPPORTING POLICIES AND MEASURES

3.1 Decarbonisation dimension

3.1.1 Greenhouse gas emissions, removals and storage

The plan fully embeds the increased climate targets included in the Effort Sharing Regulation and LULUCF Regulation, as part of the **Fit for 55 legislative package**.

Luxembourg has committed to achieve **climate neutrality** by 2050 (Climate Law of 15 December 2020). The draft updated plan includes concrete pathways to 2030, 2040 and, for certain variables, to 2050. With existing measures (WEM) and with additional measures (WAM) projections are performed with a time horizon of up to 2050. They show net GHG emissions (i.e., including LULUCF and excluding international aviation) of 5 million tonnes of CO₂ equivalent (CO₂ eq.) by 2050 considering existing measures and of 1 million tonnes of CO₂ equivalent with additional measures. This is equivalent to projected reductions in 2050, compared to 1990, of 62% and 92%, respectively. The projections are identical to those submitted in March 2023 under Art. 18 of the Governance Regulation. Thus, the information provided in the draft updated plan confirms the assessment carried out in the 2023 Climate Action Progress Report. Overall, based on the available information, progress by Luxembourg is likely to be consistent with the achievement of the EU climate-neutrality objective.

The **Effort Sharing Regulation** (ESR) sets Luxembourg's 2030 emissions reduction target at -50% by 2030, compared to 2005 levels. The draft updated plan sets a more ambitious domestic target for these sectors of -55%. The plan projects emissions from the effort sharing sectors to be above the 2030 target (-35.1%) in the 'with existing measures' (WEM) scenario, while in the 'with additional measures' (WAM) scenario the target is over-achieved (-57.8%), highlighting an appropriate levels of climate action but also the importance of effectively implementing the full range of policies and measures in the plan. In 2021, Luxembourg's ESR emissions were below the Annual Emission Allocation (AEA) by 0.3 Mt CO₂ eq. Member States have flexibilities under the ESR to comply with their targets. No specific use of ESR flexibilities is mentioned by Luxembourg. To assess whether Member States comply, the use of saved AEAs from previous years and the ETS flexibility if needed are taken into account.

The draft updated plan also refers to the amended Climate Law of 15 December 2020 that stipulates **sectoral climate targets** for five sectors covering all GHG emissions at national level, including the annual emission allocations for five sectors for the period up to 2030 i.e., (1) energy and manufacturing industries, construction; (2) transport; (3) residential and tertiary buildings; (4) agriculture and forestry; and (5) waste and wastewater treatment.

Table 2: ESR targets and projections in Luxembourg's draft updated NECP

| ESR target and projections ⁶ | | | | | |
|---|--------------|-------------------------------------|--|-----------------------|-----------------------|
| | 2030 target* | 2021 performance (inventory data) * | 2022 performance (approximated data) * | 2030 WEM projection * | 2030 WAM projection * |
| Luxembourg | -50% | -20.2% | -30% | -35.1% | -57.8% |
| EU | -40% | -14.5% | -16.9% | -27% | -32% |

*Compared to the 2005 emissions as set out in Annex I of Commission Implementing Decision (EU) 2020/2126.

The plan reflects the increased ambition of the revised **LULUCF Regulation** and the 2030 national target requiring Luxembourg to deliver -27 Kt CO₂ eq. net removals to reach the total value of -403 Kt CO₂ eq. in 2030. According to the projections submitted by Luxembourg removals in the LULUCF will amount to -430 Kt CO₂ eq. with additional measures. Although the plan sets out a pathway to increase the contribution of the land sector to the overall EU's enhanced climate target, the information on policies and measures to support the LULUCF sector is limited and does not indicate the scope of each measure. The draft updated NECP does not provide information on the status and progress to be made in ensuring the enhancements to higher tier levels/geographically explicit datasets for the monitoring, reporting and verification, in line with the provisions under Regulation (EU) 2018/841. Overall, Luxembourg is well on track to meet its 2030 targets under a WAM scenario, and it presents how its policies and measures for the LULUCF sector will contribute to the long-term transition to carbon neutrality by 2050.

The plan includes policies and measures for improved access to **zero- and low-emission mobility**, including measures to promote soft mobility. Moreover, it is aligned with the provisions of the new Alternative Fuels Infrastructure Regulation as regards national policy frameworks for alternative fuel infrastructure for low- and zero-emission vehicles and mobile assets across transport modes, including measures for recharging points and hydrogen refuelling stations.

The plan refers to the need to steadily increasing the deployment of **sustainable aviation fuels (SAF)** as defined in the RefuelEU Aviation Regulation but is still analysing potential measures to support their uptake and deployment at national airports. Luxembourg specifically mentions alternative propulsion systems like renewable hydrogen and electricity. Luxembourg sticks to the Commission proposal in the binding shares of SAF and should update the plan to the SAF shares in the final agreement (c.f. measure 417). Luxembourg underlines the importance of SAF in the decarbonisation of aviation and is finalising a feasibility study on hydrogen production for export with Cape Verde. Luxembourg is following this development very closely due to the difficulty to electrify aviation in absence of renewable hydrogen. The plan also includes measures for the electrification and the introduction of zero-emission technologies and modal shift towards

⁶ The comparison between the ESR target and emission projections does not take into account the flexibilities available for Member States under the ESR to comply with their 2030 targets. The ESR emissions will be comprehensively reviewed in 2027 (for the years 2021-2025) and 2032 (for the years 2026-2030).

low-carbon modes (e.g., fiscal measures or environmentally harmful subsidy reforms, deployment of infrastructure for zero-emission aircrafts).

Regarding **Carbon Capture, Use and Storage (CCUS)**, the plan does not identify annual emissions that could be captured by 2030 from ETS and non-ETS sources, nor any concrete estimation of geological CO₂ storage capacity. Despite CO₂ storage not being specifically mentioned, the plan states that Luxembourg has inadequate geology and limited storage capacity. The plan does not foresee the deployment of any dedicated CO₂ transport capacities. However, Luxembourg proposes to establish a public-private research hub to conduct a holistic analysis of CCU and Direct Air Capture (DAC) technologies and an appropriate strategy for their implementation.

The draft updated plan pays attention to **mitigating non-CO₂ emissions** in different sectors. Existing and planned measures cover **methane** emissions in agriculture (e.g., No. 701 Aid to reduce the livestock load) including enteric fermentation (e.g., No. 702 Aid for the use of food additives to reduce methane emissions from digestion) and manure management (e.g., No. 215 Biogas strategy and new incentives (financial and other) for biogas), and in waste management (e.g., ban on landfilling of untreated municipal waste by 2030; No. 605 Methane recovery systems), **N₂O** from agricultural soils (e.g., No. 709 Legal framework for the use of nitrogen fertilisers in agriculture) and manure management (e.g., No. 705 Support for the integration of manure (eco-scheme)), and emissions of **F-gases** (e.g., references to Regulation (EU) No 517/2014). In addition, the plan includes measures on the development of **biogas and bio-methane** (e.g., No. 416 Bio-methane in transport sector) and links their production to the use of agricultural waste, landfills, and sludge from wastewater treatment plants (e.g., No. 215 Biogas strategy and new incentives (financial and other) for biogas). However, the plan does not address methane emissions in energy, including fugitive emissions and fuel combustion.

The plan recognises the need to reduce emissions from the **agriculture sector** but does not prioritise them. Nevertheless, the draft updated NECP shows some reductions in 2030 in the agricultural sector in a WAM scenario.

The analytical basis of the plan includes a detailed bottom-up assessment of the **impact of policies and measures** on the achievement of the GHG mitigation targets contained in the plan. The policies and measures are described in sufficient detail in terms of scope and timing but lack estimates of their individual impact. The plan provides no evidence of exploiting synergies across policy areas.

The draft updated plan reflects partial progress towards **international commitments** under the Paris Agreement. Coal use in the electricity sector has already been phased out in Luxembourg. The phasing out of fossil fuel subsidies is not at all discussed extensively. The plan only mentions that an increase in excise duties for diesel and petrol, as means to reduce emissions from transport due to transit refuelling is planned.

On 4 November 2021, Luxembourg submitted to the Commission its **national long-term strategy**. The strategy includes the goal of achieving climate neutrality by 2050 as does Luxembourg's report on the status of implementation of its initial NECP submitted in March 2023.

3.1.2 Adaptation

Luxembourg has **demonstrated an awareness of climate vulnerabilities and risks** that could affect the achievement of national objectives, targets, and contributions across various dimensions. Notably, vulnerability related to structural or seasonal water scarcity poses a significant threat to Energy Union objectives. Luxembourg has taken steps to address these risks through measures such as improving water efficiency and enhancing the resilience of energy systems.

Luxembourg **identified adaptation goals** in its initial NECP of 2019, although these goals are somewhat vague and not always quantifiable through specific indicators. In comparison to that document, Luxembourg has made some progress in its draft updated NECP, formulating adaptation goals including the inclusion of new goals related to the Energy Union dimensions.

Luxembourg has also described both implemented and planned nature restoration measures as well as **nature-based solutions** and their expected impacts in terms of reducing climate risks. Investments aimed at preserving biodiversity and contributing to climate adaptation are evident in Luxembourg's plan, notably through the development of monitoring statistics, models, and indicators, as well as initiatives like the Nature Pact with municipalities. However, there is room for more emphasis on nature-based solutions as regards draining and water retention and soil erosion avoidance.

Innovative approaches, such as insurance policies and fiscal measures addressing the climate protection gap, are part of Luxembourg's strategy, which includes measures like tax incentives for energy renovation and revisions in registration tax for low-emission vehicles.

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3.1.3 Renewable energy

The renewable energy contribution proposed in the draft updated NECP is a share of 37.0% of the national gross final consumption of energy in 2030 and is based on the WAM scenario. Absolute values in terms of energy were also included. This includes 3,500 GWh acquired through European cooperation mechanisms (1750 GWh through statistical transfers and 1,750 GWh through the Renewable Energy Financing Mechanism (REFM)). The 37.0% contribution is in line with the share of 37% resulting from the formula in Annex II of the Governance Regulation. The scenarios are detailed and provide yearly overall renewable energy contribution trajectories, up to 2030 and a projection for 2040. The indicative trajectory to reach the 37.0% contribution in 2030 is provided, including specific reference points for 2022 (renewables share of 13.5%), 2025 (24.0%) and 2027 (29.0%).⁷ The submitted reference point for 2022 (13.5%) reaches the trajectory (of 13%) calculated in line with the EU 2030 renewable energy target of 32%, which was in force at that time. The reference points for 2025 and 2027 are above the trajectory (22% and 28%

⁷ Reference points of 18% by 2022, 43% by 2025 and 65% by 2027 pursuant to Article 4(a)(2) of Regulation 2018/1999 pursuant to Article 4(a)(2) of Regulation 2018/1999

respectively) calculated in line with the increased EU 2030 renewable energy target of 42.5%⁸.

The renewable electricity generation is projected to reach 37.3% in 2030, with solar PV, wind and solid biomass becoming the main sources of renewable electricity (36.7%, 34.4% and 20.6% respectively). This is a change in the current mix (2021) amongst the three largest renewable energy sources where wind (32.7%) outranks solid biomass (29.7%) and solar PV (16.7%). When renewable energy acquired through European cooperation is taken into consideration Luxembourg has an ambitious aim for the electricity sector with a complete decarbonisation by 2035.

The use of renewable energy in the heating and cooling sector is projected to reach a share of 40.3% by 2030. The corresponding increase is above the mandatory average annual increase set out in line with the revised REDII, which is below the indicative top up resulting in a 3.1 percentage point average increase over 2021-2030. This is notably achieved through significantly higher objectives for both heat pumps (1 036GWh in 2030 v. 422 GWh previously), solid biomass (2 259 GWh in 2030, v. 672 GWh previously), and renewable hydrogen for industry (113 GWh by 2030 v. no previous objective). Biomass remains dominant and will contribute to most of the increase RES share in heating and cooling, with an increase of 77% in consumption between 2022 and 2030. The contribution of heat pumps to heating and cooling should increase almost sixfold in that period. The plan does not indicate whether waste heat or electricity should be counted towards the average annual increase⁹. Concerning **district heating and cooling**, the draft updated NECP is missing a clear description of how Luxembourg intends to achieve its indicative annual average set in the revised REDII for the period 2021-2030. The draft updated NECP does not contain an average share of renewable energy use in **industry** over the period 2021-2030, neither a share of renewables in **buildings** sector by 2030.

In the transport sector, the share of renewable energy is projected to reach 18% in 2030. For the transport sub-targets, the draft updated plan mentions the introduction of an obligation for the incorporation of sustainable biofuels into road fuels. An advanced biofuel target was included with a share of 1% in 2025 and 3.5% in 2030. Multipliers are included in the calculation of this trajectory. The share of energy from biofuels produced from food and feed crops is limited to 5%. Biofuels with high indirect land-use change-risk are gradually phased out. The draft updated NECP does not set an electric vehicle target by 2030; however, it provides extensive details about existing and new measures related to electro-mobility (both relating to vehicles and to recharging infrastructure).

The draft updated NECP does not provide information on the capacity of electrolyzers in 2030. It does mention any support scheme aimed at providing remuneration to produce **renewable hydrogen**. Regarding **international partnerships** to facilitate imports of renewable hydrogen the national hydrogen strategy is referred to which, among other key measures, aims at fostering cooperation with EU Member States and third countries.

⁸ Given that the provisionally agreed RED was not yet in force by the deadline of the submission of the draft NECPs, the value for 2022 has been compared to the trajectory values calculated on the basis of the 2030 EU renewable energy target of 32%. The reference points for 2025 and 2027 are compared to the trajectory calculated on the basis of the increased EU target of 42.5% in line with the revised RED.

⁹ Using a 2020 share of 12.6% from EUROSTAT SHARES yields required values of 16.6% and 22.1% in 2025 and 2030 respectively. Luxembourg reaches 21.2% and 28.4% for those respective years.

The **policies and measures** to support the achievement of the proposed objectives and contributions for renewable energy are provided ranging from raising awareness on renewable energy sources to concrete remuneration schemes. Regarding the status of the measures, some are planned and other already implemented through legal acts. From the description, however it is hard to assess the actual impact of the measures on whether they will suffice in reaching the contribution on renewable energy share by 2030.

For example, in the **electricity sector** three measures are mentioned which can be categorized on different maturity levels. A risk reduction instrument is planned which includes long-term renewable power purchase agreements. On Guarantees of Origin, Luxembourg, propose no enhancement and will continue the activities on basis of the existing regulatory framework. When it comes to **Joint projects**, as mentioned before, Luxembourg also plans to secure renewable energy through cross border cooperation using the Renewable Energy Financing Mechanism and statistical transfers. Two calls under the REFM have already been organised and for the period 2018-2020 statistical transfers were procured with Estonia and Lithuania.

A regulation which is under analysis aims at installing PV systems on all residential buildings. It will ensure that lower income households also reap the benefits of the energy transition in Luxembourg, through **self-consumption** which will lower their energy bill. Luxembourg has not indicated in its draft updated plan whether it has put in place a dedicated strategy on energy system integration, but it refers to a Flexibility report within The Pentilateral Energy Forum (Penta) which addresses the needs and sources of flexibility in the period 2030-2050.

Regarding **heating and cooling** a recast of a national law is being analysed which aims at establishing a legal framework for the promotion of efficient district heating and cooling. However, the plan does not include measures to promote renewable-based electrification of industrial processes to replace fossil fuels used for industrial heating with the aim of reducing the use of fossil fuels.

On **bioenergy** the draft updated NECP includes data on the projected evolution of the share of renewable sources, per type, also including biomass and biogas as distinct categories and per sector (differentiating among electricity, heating and cooling and transport). The draft updated NECP also includes projection of biogas consumption in the Renewable Energy Sources for Electricity (“RES-E”) and Renewable Energy Sources for Heating and Cooling (“RES-HC”) sectors, up to 2030 as well as the projected evolution of energy production from solid biomass in those sectors.

However, biomethane production was considered but not elaborated further. The draft updated NECP does not include data on biomass supply by feedstock and origin, nor on the source of **forest biomass** used for energy and the impact on the LULUCF sink. In particular, the draft updated NECP does not include either the assessment, of the domestic supply of forest biomass for energy purposes in 2021-2030 in accordance with the revised sustainability criteria under the revised REDII and of the compatibility of the projected use of forest biomass for energy production with Luxembourg’s new obligations under the revised LULUCF Regulation, particularly for 2026-2030.

An analysis of relevant **permitting legislation** is being planned which aims to identify situations where an individual authorisation is not required or could be replaced by other legislative means or where the procedures for obtaining such an authorisation could be lighter, accelerated or even prioritised. However, the draft updated NECP does not include

a **mapping of the areas** necessary to achieve the national contribution to the Union's 2030 renewable energy target or on the designation of renewables acceleration areas and dedicated infrastructure areas in the line with revised REDII.

3.2 Energy efficiency (including buildings) dimension

Energy savings are presented as a pillar of the draft updated NECP, with Luxembourg targeting to reduce energy consumption by 0.13 Mtoe/year until 2030 compared to the 2017-2019 average¹⁰. This corresponds to a corrected national contribution of 3.05 Mtoe for final energy consumption (compared to 2.71 Mtoe according to the EED recast Annex I formula results). No target in primary energy consumption has been provided. Luxembourg's reported 2030 contribution for final energy consumption deviates from the theoretical results from the use of formula in the EED recast Annex I by 12%.¹¹

The 2030 target for final energy consumption is set at a lower level as compared to the Luxembourgish 2020 energy efficiency target (-27% for final energy consumption¹²). The updated target results from the simulation of the additional measures scenario, based on the expected impacts from the measures presented in the draft updated NECP. The measures included in the scenario analysis are described in detail, but their individual contribution towards the target is not quantified.

In line with the 2014-2020 period, Luxembourg opted for the default approach in implementing the provisions on the renovation of public buildings. The target on renovating the central government's buildings is well described in the draft updated NECP but does not take into account the new ambition of the EED recast. Preparatory works are underway to cover all public bodies in line with the requirements of the EED recast. The described measures are not quantified and information on the exclusion of public transport or armed forces are missing. Statistics on energy consumption of public transport and armed forces are, however, under preparation.

The draft updated NECP provides satisfactory information on what measures will be used to deliver the savings required post-2020 under **Article 7 EED (Article 8 EED recast)**. The updated total 2021-2030 cumulative savings target is 42,538 GWh, calculated in line with the ambition of the EED recast. The annual savings target for each year of the period is not quantified. Luxembourg adopts a mixed approach, including both an energy efficiency obligation scheme (EEOS) and alternative measures. The EEOS is supposed to cover 13,750 GWh of the cumulative savings target for 2021-2030. The CO₂ tax on liquid fuels is supposed to act as a key complementary alternative measure, providing cumulated savings of 27,970 GWh. Among the other eleven reported measures, the promotion of electric vehicles and public transport hold the largest share, expected to deliver respectively 7-11% (electric vehicles) and 6-9% (public transport) of the saving requirement.

¹⁰ The 2017-2019 average has been calculated based on the EED recast FEC definition, and the savings per year have been calculated for the period 2021-2030.

¹¹ According to Article 4(4) EED recast, a Member State shall ensure that its contribution in Mtoe is not more than 2.5% above what it would have been had it resulted from the EED recast Annex I formula.

¹² The comparison has been done with the 2020 target as included in the final NECPs 2020 JRC assessments (4.2 Mtoe FEC)

The draft updated NECP includes a wide range of measures covering all sectors. Besides the updated EEOS and the complementary alternative measures (mainly carbon taxation) under Article 7 EED, the main focus is on buildings, notably building renovation (29 measures in total). Overall, Luxembourg's draft updated NECP presents in detail the planned measures to achieve the 2030 energy efficiency goals including both the measures adopted after 2020 and the new planned measures towards 2030. However, the expected savings are not reported for the different set of measures, except for the cumulated energy savings of the EEOS and carbon taxation.

The draft highlights that the '**energy efficiency first principle**' is the basis for the draft updated NECP and notably for all measures in the building sector.

The NECP reports that the existing measure on energy audits will be updated in line with the provisions for **Article 11 EED recast**. Energy performance contracting will be considered. In addition to this obligation, SMEs and other companies not obliged to carry out regulatory audits will be encouraged to carry out energy audits under the New Business Climate Pact ("Klimapakt fir Betriber"). Figures on energy audits are not reported.

Financial needs of each of the policies and measures listed in the energy efficiency dimension are not quantified, but overall quantifications are presented in the WAM scenario for the years 2023-2030. The use of a National Energy Efficiency Fund is not clearly included as a separate measure to finance energy efficiency.

The draft updated NECP updates the key elements, targets and milestones of the 2020 long-term renovation strategy (LTRS). In particular, the draft updated NECP increases the 2040 ambition in terms of building energy use's reduction.

The NECP reports 29 measures in the building sector and further measures on buildings in the industry and renewables headings of the NECP. While the impacts on saving of each measure is not quantified, the overall impact is presented. The key focus of building renovation is on heating replacement and electrification (heat pumps).

The measures include a comprehensive set of economic, regulatory, information, fiscal and education actions. The draft updated NECP explains that incentives, support schemes and information will be used largely to incite renovations and reaching ZEB standard rather than recurring to regulatory measures apart from phasing out fossil heating systems. The energy renovation strategy focusses on worst-performing residential buildings. A national body supporting energy renovation, decarbonisation and the implementation of photovoltaic installations for residential buildings is planned. If implemented, this measure will pave the way to the implementation of the future minimum energy performance standards as presented in the EPBD recast proposal.

All new residential buildings will have to have a PV installation and the Luxembourgish state will pay for the installation for households who cannot afford it. Sustainable construction and reduction of the environmental impact of construction such as whole lifecycle emissions are also addressed. However, the proposed policies and measures lack individual quantification as regards to the FEC, PEC and GHG impacts. In addition, milestones for the renovation of buildings are not extended beyond residential buildings as required.

3.3 Energy security dimension

Fossil fuels still play a very important role in Luxembourgish energy mix, as in 2021 they still accounted for 79% of the gross available energy¹³. According to the draft updated plan, this share is however expected to dramatically decrease to around 63% in 2030 and 38% in 2040 in the WAM scenario; which is a very ambitious trajectory. The draft updated plan also highlights Luxembourg's main objective to ensure a high level of security of energy supply while striking a balance between the level of security and associated costs for the state and consumers.

The plan underlines Luxembourg's **strong dependence on imports for its energy** needs because of high electricity demand from the industrial sector, a lack of gas storage facilities and due to its limited energy resources. The draft updated plan therefore recognises that domestic energy sources will not be sufficient to cover Luxembourg's energy needs in the future and that a fully operational European Energy Market is needed to ensure the country's energy security.

Luxembourg's dependence on energy imports from third countries has decreased from 21% in 2013 to 10% in 2021¹⁴. Still, Luxembourg details its intention to reduce its energy imports dependence for different energy carriers.

Natural gas plays a relatively marginal role in Luxembourgish energy system, accounting only for 16% of the energy mix and 8% of the electricity mix in 2021, which is substantially below the EU27 average¹⁵. Luxembourg is fully dependent on imports for its gas consumption, and it shares a common market area with Belgium. In 2021, it relied on Russian exports for 11% of its gas needs.¹⁶ It also does not have any gas storage capacity nor solidarity arrangements with other Member States.

Luxembourg intends to reduce its dependence on gas imports by increasing energy efficiency and by encouraging the transition from gas to electricity in all sectors of society in particular in the heating and cooling sectors due to the increased ambitions in renewable energy deployment(Section 3.1.3). Thus, with the additional measures described in the draft plan, the country aims at decreasing national total gas consumption from 8,267 GWh in 2022 to 4,914 GWh in 2030.

In particular, in terms of heating and cooling, Luxembourg has dramatically increased its ambitions in terms of thermal renewables deployment: while the previous version of the plan in 2020 aimed at a share of 30.5% in 2030, the updated version now foresees a share of 40.3%.

Finally, the draft updated plan emphasises the importance of EU-wide cooperation for gas security of supply and highlights the significance of EU-wide measures taken, notably during the energy crisis of 2022. In this regard, Luxembourg has managed to cut its gas consumption between August 2022 and August 2023 by 27% compared to the average of the past 5 years, which is substantially above the -15% indicative target and the EU27

¹³ Eurostat.

¹⁴ Eurostat.

¹⁵ Eurostat.

¹⁶ European Commission, https://economy-finance.ec.europa.eu/system/files/2023-06/ip240_en.pdf.

average (-18%)¹⁷. While the draft plan adequately describes measures that have been implemented to cut gas demand, it does not however show how they are integrated into the medium-term planning towards 2030.

However, all in all, the draft updated plan lacks detail on the policy measures envisaged to enhance Luxembourgish security of gas supply.

In the **electricity sector**, Luxembourg aims to almost phase out gas-fired power generation entirely by 2040. An expansion in electricity produced from renewable energy sources is generally set to enable Luxembourg to reduce its dependence on electricity imports. However, due to the significant demand for electricity from the industrial sector, national energy sources will not be sufficient to cover Luxembourg's energy supply in the future. In the area of load flexibility, Luxembourg aims to significantly increase the share of consumers actively participating in the electricity market.

The draft updated plan further outlines policies and measures that focus on improving security of supply in the electricity sector. This includes the report on security of supply in the electricity sector (since 2007 every two years), the Risk Preparedness Plan under Regulation 2019/941 on risk-preparedness in the electricity sector, the support group "Security of Supply" of the Pentalateral Energy Forum and the network development plans. The draft updated plan lacks details on the development of energy storage, aside from the assessment of the appropriate level of security for hydrogen supply to be achieved, since hydrogen is recognised as a potential solution to provide flexibility to the electricity grid as seasonal storage. The country does not seem to have a dedicated strategy for the deployment of power storage, nor does it have measurable targets. According to a study on storage commissioned by the European Commission, the current operational Luxembourgish power storage capacity is around 1,294 MW (mainly pumped hydro)¹⁸.

Luxembourg is highly dependent on **oil products** which accounted for 61% of its energy mix in 2021 (63% in 2015).¹⁹ Imports of oil products come mostly from four neighbouring countries: Belgium, Germany, France and the Netherlands. Transport is by far the largest oil consuming sector (83%)²⁰. A significant part of consumption comes from non-residents refuelling their vehicles due to a favourable tax regime.

Oil emergency stocks play an import role for security of supply given that the country has no domestic production, refinery nor access to the sea. The draft updated NECP does not assess the impact of the large proportion of stocks held abroad (86%) mostly in the form of crude oil on availability/accessibility of stocks in case of crisis. The intention of Luxembourg to lower dependence on oil products by decreasing oil consumption through carbon pricing, increasing the share of renewable energy sources and by establishing

¹⁷ DG ENER Chief Economist Team based on ESTAT NRG_CB_GASM (sub-series IC_CAL_MG subtracted by TOS) in TJ (as of 29 September 2023, 11:00)

¹⁸ This figure is derived from the database which accompanied the ENTEC study on Storage funded by the European Commission and published in November 2022, by taking into account only the "operational" facilities: https://op.europa.eu/en/publication-detail/-/publication/dfcaa78b-c217-11ed-8912-01aa75ed71a1/language-en?WT_mc_id=Searchresult&WT_ria_c=37085&WT_ria_f=3608&WT_ria_ev=search&WT_URL=https%3A//energy.ec.europa.eu/

¹⁹ https://energy.ec.europa.eu/data-and-analysis/eu-energy-statistical-pocketbook-and-country-datasheets_en.

²⁰ Eurostat. 2021.

incentives to switch to electric cars and electric heating systems is positively noted. The draft updated NECP does not assess the adequacy of the oil infrastructure (oil stocks) with the expected decline in oil demand.

The draft updated plan does not feature any measure aimed at dealing with **cybersecurity** threats, ensuring energy infrastructure resilience to extreme weather events and more generally its adaptation to climate change, nor on critical raw materials supply chains dependencies.

The draft updated plan only briefly describes the measures to be implemented **in case of a security of gas supply crisis**. Luxembourg did however submit its National Risk Assessment, its Preventive Action Plan and its Emergency Plan, as well as the Common Risk Assessments for the United Kingdom, Denmark, Norway, Baltic Sea, Belarus and Ukraine Risk Groups.

3.4 Internal energy market dimension

Luxembourg's **interconnection capacity** already exceeds by far the European target of 15% for 2030. The level of interconnection (N-0) with Germany is currently around 230%, calculated in relation to the maximum annual load. It is welcome that Luxembourg intends to expand its network even further increasing the level of interconnection to around 400% by 2030.

With regards of the increase of the renewable energy target, and the need to enable the consumers to rapidly reap the benefits of it, the plan indicates that today already more than 98% of smart meters deployed for electricity. Beyond smart meters it identifies the deployment of data infrastructure as key. An energy data platform where consumers can consult the relevant data is also planned to become active in the electricity market envisaged by 2026. The platform is expected to play a significant role in the deployment of flexibility in the energy system. In addition, a regulatory framework for aggregator activity is foreseen, but the plan does not contain a specific date. The legal framework promotes self-consumption of renewables and allows for the creation of energy communities.

Luxembourg also intends to cooperate regionally within the Pentalateral Energy Forum to implement EU legislation and promote flexibility in the region to provide key policies and measures to incentivize demand response, though, without providing a clear overview of the national flexibility needs, or setting clear targets and objectives for demand response, storage and flexibility. Moreover, the plan does not indicate specific measures to accelerate the deployment of electricity storage, neither to engage the system operators in facilitating the penetration of flexibility services.

Regarding energy poverty, the NECP outlines the indicators used to measure energy poverty which leads to estimate a sharp increase of 4% from 2020 and 2021 to 2022 (without the so-called tripartite policy measures). Luxembourg addresses energy poverty through social and energy measures. Social policy related measures, addressing general poverty as well as affordability of housing include measures like minimum wage, living allowance, specific assistance related to rent increase etc. In addition, households unable to pay their electricity and gas bills receive special assistance as well as a guaranteed minimum supply of domestic energy under specified conditions.

Regarding specific energy measures, energy poverty is addressed particularly in the buildings section with a dedicated measure targeting energy poor households, that benefit from a personalised energy advice as well as a subsidy for the replacement of energy-intensive household appliances. Moreover, Luxembourg primarily focuses on i) a subsidy to support the switch away from an oil boiler or wood-fired heating, ii) subsidies for housing insulation, with a doubling of the subsidy (“Topup social Klimabonus”) for low-income households. Luxembourg has also introduced subsidy for low interest climate loans and the introduction of a mandatory fund for multiple ownership buildings.

However, no specific sub-target for energy poverty is reported under the energy savings obligation.

In addition, the draft updated plan does not explore sufficiently synergies between different policies and measures to develop demand response, and energy savings in a targeted manner to have direct effect on households on energy poverty and empower vulnerable consumers.

3.5 Research, innovation, competitiveness and skills dimension

3.5.1 Research and innovation

The draft updated NECP reports on Luxembourg’s research and innovation (R&I) priorities. It notably includes production and storage of renewable energy sources with a focus on photovoltaics and hydrogen, the development and management of smart electricity grids, and reduction of the impact of buildings material. The draft updated NECP does not, however, provide information about pathways to 2030 and 2050 for specific clean energy technologies.

The draft updated NECP mentions that Luxembourg established a **National Centre of Excellence in Research** (NCER) to coordinate research on energy transition and climate action. It also established a strategic R&I programme and public-private partnerships on the matter. An excellent example is the foreseen support for the establishment of research chairs and public-private or public-public partnerships at the University of Luxembourg and at public research centres. The draft updated plan indicates that Luxembourg is committed to establish an aid scheme for enterprises – for partnerships on research, development and innovation.

However, the draft updated plan does not include national **target and spending for research and innovation** in specific clean energy technologies. Luxembourg spends about 1% of GDP per year on R&I but the country states that it is currently impossible to provide the split per area and indicate how much of this funding is dedicated to clean energy R&I.

The Luxembourgish draft updated NECP does not mention the SET Plan. Nevertheless, in the draft updated NECP, European cooperation is mentioned as an important pillar for achieving the short-, medium- and long-term objectives of Luxembourg. For its hydrogen strategy, Luxembourg cooperates with the other Benelux countries, Germany, Austria, France and Switzerland. There is also a potential for enhanced cooperation in areas such as photovoltaic technology and hydrogen production R&I. However, Luxembourg has not provided national goals or plans with regards to international R&I cooperation nor examples of best practices for concrete technologies/areas.

3.5.2 Competitiveness

Luxemburg has put in place several measures and investments intended to support the competitiveness of its industry, mostly linking these to the country's decarbonization objectives. Aid scheme to compensate for the additional costs associated with the ETS system for the period 2021-2030, capital grants, repayable advances, subsidies, and contracts for difference (CfD) as well as power purchase agreements. The plan also foresees the development of de-risking instruments for certain sectors at particular risk of a competitive disadvantage. Circularity is also addressed. However, the draft updated plan does not mention specific investments allocated to these measures. Moreover, the plan does not provide information on reforms or investments related to enhancing manufacturing capacities of clean energy technologies, equipment and components, or how Luxembourg will ensure the resilience of supply chains for clean technologies if there is not enough domestic production of these components or equipments. Furthermore, there is limited information on measures addressing the digitalisation of the energy system and recyclability.

3.5.3 Skills

The draft updated plan identifies skills shortages for the development of strategic sectors, in particular R&I of new energy technologies, acceleration of permitting and performing environmental assessments. Several measures are presented throughout the draft updated plan to overcome them to boost European competitiveness in clean energy technologies, equipment and components. Development of initial and continuous vocational trainings is one of the priorities. Also, Luxembourg seeks to promote learning methods for the development of skills needed for systemic transformations, applicable also in the context of the clean energy transition.

4 JUST TRANSITION

Just transition aspects are **partially addressed in the draft updated plan**. Luxembourg quantifies some employment impacts of the energy and climate transition, but social and skills impacts, or any other distributional impacts on vulnerable groups, are lacking. Furthermore, there is no adequate analytical basis for the preparation of the Social Climate Plan, as assessed in Chapter 7.

However, the draft updated plan describes some measures to address **access and preservation of employment**, namely training and (re)skilling programmes linked to green transition, including in the building sector, and makes references to support measures for workers who will be negatively affected by the transition financed via the Just Transition Fund. In addition, the draft updated plan also elaborates on the measures linked to the **vocational education**. Furthermore, it sets out in detail the various social measures and programmes that aim to contribute to a just transition, notably in the field of energy affordability and to mitigate the negative impacts of the energy and climate transition. These include a social redistribution of the carbon tax revenue, various financial support schemes including climate loans, social aid schemes for housing renovations and mobility, support schemes for enterprises and those supported with the Just Transition Fund. Various measures, also those specifically targeting **energy poverty**, inter alia through income support, better access to energy efficient housing, as well as various measures aiming to

enhance consumer empowerment, are included in the plan, as discussed in Chapter 3. Finally, the draft updated plan mentions some resources, but it is not clear which ones will be specifically devoted to supporting a fair transition in addition to the Just Transition Fund.

5 REGIONAL COOPERATION

The draft updated plan foresees a **strategic role for regional cooperation**. The plan includes targets and contributions, policies and measures related to the Energy Forum Pentilateral and the North Seas Energy Cooperation (NSEC). The draft updated plan considers regional cooperation for security of supply, market integration and decarbonisation. While the plan emphasises the role of regional and EU-wide cooperation for gas security of supply, Luxembourg still has no solidarity arrangements with its neighbours, out of the two required (with Belgium and Germany).

NSEC focuses on increasing offshore targets for wind and other energy sources, in line with the EU Offshore Renewable Energy Strategy. However, no national offshore renewable energy targets are specified by technology type for the North Sea basin. The draft updated NECP also refers to Member States' non-binding agreements under the TEN-E regulation. The non binding agreements increase the total ambition level for installed offshore energy compared to the offshore strategy, including for the North Sea region.

Finally, the draft updated plan lacks details on further cooperation with neighbouring countries and regulatory authorities.

6 INTERNAL COHERENCE AND POLICY INTERACTIONS WITHIN THE DRAFT UPDATED NECP

The draft updated plan includes assessments and examples of interactions within and between the dimensions. For example, the draft updated plan highlights the importance of consistency between electrification targets for vehicles and the roll-out of charging infrastructure and includes measures to promote the deployment of charging infrastructure in line with the expected increase in electric vehicles. The draft updated plan also acknowledges the need for consistency between LULUCF targets and the use of biomass as a renewable energy source and includes measures to ensure that the use of biomass is sustainable and does not lead to negative environmental impacts. Furthermore, the draft updated plan recognizes the importance of consistency between investments in security of supply, a fully functional internal energy market, and decarbonisation objectives, and includes measures to enhance the security and resilience of energy infrastructure while promoting the transition to a low-carbon economy.

However, the draft updated plan also emphasizes the need for consistency of measures taken at different levels of government and includes measures to promote coordination and cooperation between different levels of government and stakeholders.

7 STRATEGIC ALIGNMENT WITH OTHER PLANNING INSTRUMENTS

Luxembourg submitted a first draft in July 2023, which still lacks detailed information. A targeted amendment to its **Recovery and Resilience Plan** in line with Article 18(2) of the

Regulation (EU) 2021/241 was drafted on 11 November 2022. However, Luxembourg has not yet submitted its REPowerEU chapter; with the ongoing formation of a new government, the submission of the amended RRP and the REPowerEU chapter should take place later this year. Several reforms and investments included in the RRP of Luxembourg can be partially identified in the draft updated NECP. Concretely, this concerns 2 out of 3 climate relevant measures in the RRP (i.e., those with 100% climate tagging). Measures that are reflected do, however, lack granularity and detail to allow for a full comparison with those in the RRP. This is for instance the case for the support scheme for charging stations, where limited information is provided. However, one key measure among those 100%-climate tagged is not reflected in the draft updated NECP. This is the case for the ‘Naturparkt’ project with the municipalities to provide financial support for actions to protect nature and prevent biodiversity loss.

The draft updated plan is fully consistent with the **Territorial Just Transition Plan** (TJTP). The Just Transition Fund (JTF) and the TJTP are mentioned as one of the cross-cutting measures for the reduction of GHG emissions and removals.

In the draft updated plan, Luxembourg does not provide the quantification of the climate impacts of measures currently included in the **CAP Strategic Plan** (CSP), thus the plan does not explain whether the CSP is in line with the new LULUCF and ESR targets and whether additional measures are necessary.

The draft updated NECP provides inadequate analytical basis for the preparation of the **Social Climate Plan** (SCP) that will address the impacts of the emissions trading system for fuel combustion in buildings, road transport and additional sectors (ETS2) on vulnerable households, transport users and micro enterprises. The plan does not provide any assessment of the potential impacts of the ETS2 on the most vulnerable groups, and measures are not planned for the identification of transport poverty, nor are reduction targets mentioned. It outlines a consistent set of decarbonisation policies and measures in the buildings and road transport sectors, however inadequate information is provided on the concrete policy framework for the future SCP. It does not explain how the SCP will build on the NECP update and how the consistency between the two plans will be ensured. No information is included on the governance of the Fund.

In comparison to the Luxembourg **National Adaptation Strategy**, Luxembourg’s draft updated plan is more comprehensive and ambitious in certain aspects.

For some policies and measures, the draft plan mentions **clean air co-benefits**. Further links to clean air are missing, notably information on the impacts of planned policies and measures on projected emissions of the main air pollutants regulated under Directive 2016/2284 and on alignment with the National air pollution control programme (NAPCP).

The draft updated NECP of Luxembourg addresses the challenges identified in the 2022 and 2023 **European Semester Country Specific Recommendations**. The draft updated plan includes measures to reduce reliance on fossil fuels by accelerating the deployment of renewables, electricity transmission capacity, easing permitting procedures and investing in energy efficiency in both the residential and non-residential sectors. Moreover, the draft updated NECP includes actions to support Luxembourg municipalities in developing detailed local plans for deploying renewable energy, including wind power and photovoltaics, and for district heating and cooling systems. It also further promotes electrification of transport and investment in public transport networks and infrastructure.

8 FINANCING THE ENERGY AND CLIMATE TRANSITIONS

8.1 Investment needs

The draft updated plan includes information on the expected investment needs to implement the planned policies and measures. It contains a yearly breakdown of investment needed for the next decade for four sectors i.e., transport, energy production and distribution, buildings and industry. The cumulative overall additional investments needed for the energy transition from 2023 to 2030 are estimated at EUR 8446 Mio (prices 2023). The transport sector would require most investments, representing around 60% of the total investment needs, with a large part going to developing multi-modal infrastructure and faster deployment of electric cars, although the additional costs versus combustion engines is expected to disappear by the end of the decade. Energy production and distribution and industry and buildings are the other main investment posts. These estimates represent the additional investments under the WAM scenario compared to the WEM baseline. They are calculated using bottom-up methodologies considering all quantifiable measures. The amounts include private and public investment, as well as other public expenditure such as subsidies. The draft updated plan does not include a break down for each of the five dimensions.

8.2 Funding sources

The draft updated NECP contains aggregated information on the source of financing for the investment needed at the level of the four sectors analysed i.e., transport, energy production and distribution, buildings, and industry. Private investment, before subsidies, accounts for half of total investment. After consideration of state subsidies, it is estimated that private investment accounts for only one third. The draft updated plan does not identify the funding needs and the sources of finance at the level of individual actions. It is underlined that the measures contained in the draft updated NECP will be budgeted in line with the fiscal trajectory and rules of the Stability and Growth Pact, however, without providing further budgetary information.

Luxembourg is planning to rely mainly on the state budget and the National Climate Fund, but also mentions a few EU sources, such as the Social Climate Fund and the Just Transition Fund. Among the financial mechanisms relevant for the energy efficiency dimension mentioned in the policies and measures section are largely state-financed loan and support schemes for building renovation and the decarbonisation of transport (electrification of the fleet of vehicles registered in Luxembourg).

9 ROBUSTNESS OF THE ANALYTICAL BASIS OF THE DRAFT UPDATED NECP

Overall, the draft updated plan is based on solid quantitative analysis. Both ‘with existing measures’ (WEM) and ‘with additional measures’ (WAM) projections are delivered, including the quantitative specification in the voluntary template. The methodologies used for both projections (WEM and WAM) and impact assessment of specific policies and measures are clearly explained and referenced. The projections are presented in a largely transparent way. References documenting the modelling approach and the models used are provided. Moreover, most key input parameters have been provided, including sources.

The WEM largely covers the five dimensions of the Energy Union and most of the required variables are present. An ETS/ESR split is provided. The WEM is based on existing measure and policies adopted with a clear cut-off date of 31 December 2021. The WAM scenario includes additional policies and measures since then. Further details are missing on how the policies and measures described in section 3 relate to both specific scenarios.

The long-term projections have been prepared by the national statistics agency, STATEC in collaboration with the Environment Administration (AEV), the Rural Economy Service (SER) and experts from the various ministries concerned. The projections cover the period until 2050. The analysis is based on three main models from STATEC, including an econometric and general equilibrium model for macroeconomic and demographic projections, and an energy model to project energy consumption and GHG emissions. Overall, the projections are analytically sound. Base key figures on population and GDP are aligned with ESTAT, but not for key energy figures such as final and primary energy consumption and RES share. The draft updated plan uses the Commission's recommended parameters for reporting on GHG projections, except for carbon prices, which are not used in the modelling. The new ETS for buildings, road transport and additional sectors (ETS 2) and the possible use of the temporary derogation in case of higher national carbon taxes has been considered in the plan but not in the projection scenarios.

The draft updated plan only partially assesses the macro-economic impact for Luxembourg, illustrated by only ranges of positive and negative impacts around the long-term projection based on EU studies. The calculations of the expected impact on the yearly additional public expenditures and the loss of revenues (e.g., erosion of the fossil fuel tax base) are detailed. The same goes for the assessment of the net costs for households, where the annualised additional investments are expected to turn out lower than the annual savings from lower energy bills.

Other information such as the impacts on health, environmental, employment, education and skills as well as distributional and other just transition aspects are not presented.