Better planning of biomass in the Hungarian Long-term Climate Strategy

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Introduction

The most recent IPCC synthesis report (Sixth Assessment Report) underlines that some future changes are unavoidable and/or irreversible but can be limited by deep, rapid, and sustained global greenhouse gas emissions reduction. One of the key elements of this transformation is the spread of renewable energy. However, there are differences between the different renewable energies, especially when biomass is also on the table.

Finding the right role of different biomass feedstocks and their way and level of energetic use is a neuralgic point of climate mitigation scenarios. This is especially true for forestry biomass: the emerging conflict between biodiversity loss and the need for maintaining/increasing carbon stock on one hand, and the use of biomass as renewable energy on the other hand creating controversial plans in long-term climate strategies, without trying to find the right balances.

According to the Governance Regulation, (EU 2018/1999), Member States should have submitted their long-term strategies by January, 2020. Even though it is not obligatory, the regulation recommends, if necessary, to update the strategy every five years. In the past four years, there have been a number of reasons which makes the revision process inevitable. The "Fit for 55" package including the revision of the LULUCF Regulation and the Renewable Energy Directive (EU 2023/2413) (RED III) also affect the long-term planning on biomass. The increased ambitions raised not only by the Fit for 55 package, but the RePower EU as well, are already reflected in the revision of the National Energy and Climate Plans (NECP). This increased ambitions, and the proposed 90% reduction in net GHG emission by 2040 should be also reflected in the long-term planning document.

The aim of this document is to support the Hungarian government in the possible future revision process of the Hungarian long-term climate strategy (National Clean Development Strategy 2020-2050, further on LTS). The basis of these recommendations are the already published recommendations on the NECP revision, however, being a long-term planning document, it has special focus on the long-term LULUCF carbon sequestratoin and the planned bioenergy with carbon capture. First, we have collected our general recommendations regarding the ambitions, different targets of the LTS, which are then followed by the different biomass-specific recommendations.

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Key messages

1. Even though according to the Governance Regulation it is not obligatory to revise the strategy, given the shortcomings presented below, **the revision of the LTS should happen in 2025**, as it is recommended by the regulation.

2. The **overall ambition has to rise**, setting the 2040 target at least in line with the EU objective, but also **establish five-year policy cycles**, based on the carbon budget perspective. **Different targets should be set for emission reduction, LULUCF sequestration and industrial removal.**

3. The 2050 climate neutrality in the LTS highly relies on the future availability of industrial removals. **The scale of the industrial removal target should be a result of a sound impact assessment** conducted in a holistic and interdisciplinary manner. This is especially important for BECCS. We recommend the development of a **dedicated feasibility study to determine the true potential of BECCS technology, considering only feedstock with low-carbon cycle. But most importantly, the priority should be on emissions reduction.**

4. As short carbon-cycle feedstock is only available on a limited scale, even with counting currently unexploited ones, the **BECCS technology should not be applied in the power sector, but in hard-to-ebate sectors.**

5. **Transparent planning of the future supply and demand of biomass is needed**, in order to ensure that the planned demand is fully covered by future available biomass, considering the impact of the sustainability criteria and the LULUCF targets**.**

6. From the sustainability criteria, it is key to **integrate the long-term impact of the cascading use implementation.**

7. **Ensure that the projected need for natural sequestration can be secured, and well-defined measures are planned to reach that**, including the limitation of felling.

8. To reach the planned drastic level of firewood use reduction on household level, **dedicated household energy efficiency measure for firewood user households is needed, which promotes deep renovation, and overcomes the energy poverty aspect as well.**

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General recommendations

It is a big advantage of the draft revised NECP, that it also has a 2050 outlook for GHG emission. In detail only the planned energy-related emission can be compared to the LTS. There are three main differences:

- The gross greenhouse gas emission increased in the draft revised NECP: while in the LTS it was assumed that by 2050 it will drop to ~14,5 million t CO_2eq, according to the draft NECP it will only decrease to 18,1 million to CO_2eq.
- Already the LTS relies heavily on industrial removals: from the projected ~14,5 million t CO_2eq, 10 million tons would be offsetted by industrial removals, and the remaining 4,5 million tons by the LULUCF sector. In the draft updated NECP, the projected 2050 energy-related emission target increased by around 10%. In order to keep the net emission of the energy-related activities in 2 million tons, the industrial removals increased to 11,5 million tons.
- However, on the 2040 target, the difference is more significant, in favor of the draft NECP when it comes to higher ambition. While the proposed energy-related gross emission is 27 million CO_2, from which 10 million would be offsetted by industrial removals in the LTS, the draft NECP assumes a linear reduction between the 2030 and 2050 target, which results in 18 million tons gross, and 15 million tons net emission.

In light of these differences, and based on the ambition of the original LTS, for the overall GHG targets we are recommending the following:

1. The interim 2040 target is not ambitious enough (not even the more ambitious draft NECP's). At the time when this recommendation was developed in April 2024, only the Commission's proposal was known, which is a net 90% reduction target. This is the minimum level of the -90-95% reduction that the European Scientific Advisory Board on Climate Change (ESABCC) recommended.
2. Due to the long-term greenhouse effect of CO_2 emission, as ESABCC recommended for EU level, a carbon budget is needed which reflects the maximum amount of cumulative net emission that would be in line with the 1.5 emission reduction target.
3. As agreed at UNFCCC-level to have a 5-year common timeframe, and also to better reflect the emission reduction needed to stay within the carbon budget, the LTS should have interim targets for 2035 and 2045 as well.
4. The climate neutrality target relies too much on industrial removals. The draft version of the LTS assumed a 95% emission reduction, and planned to offset the remaining ~4,5 million tons solely by the LULUCF sector, as it stated that the potential future applicability of the industrial removals is very uncertain. The scale of the industrial removal target should be a result of a sound impact assessment conducted in a holistic and interdisciplinary manner. This paper later specifically focuses on the risks associated with BECCS technology.
5. Taking into account the risk associated with the deployment of future technologies, but also the risk associated with the future potential instability of natural carbon sinks, the utmost priority should be the emission reduction.

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6. In order to avoid any unnecessary reliance on offsetting, different targets are needed for emission reduction, LULUCF sequestration and industrial removal.
7. The emission targets only reflect emissions within the border of Hungary. However, in the globalized economy, emissions embedded in trade flows of imported goods should also be considered to best capture countries' responsibilities, as also highlighted by the ESABCC. This is especially relevant for Hungary, as the Hungarian Central Statistical office calculated, the emission based on consumption is around 12% higher than the production-based emission.
8. Even though according to the Governance Regulation it is not obligatory to revise the strategy, given these shortcomings, it should happen in 2025, as it is recommended by the regulation.

Transparency of planning with biomass

The Governance Regulation gives more flexibility to Member States regarding the structure of the strategy compared to the NECP, however, the level of detailness in the latter provides a sound basis for reliable planning. This is especially important for biomass, as it has to be ensured that the planned use of biomass is covered by sufficient amounts of sustainably sourced feedstock in a way that its use does not threaten to reach the LULUCF targets.

However, while the planned energy use is presented in a sufficient manner, distributed by the different sectors, the supply side remains unclear. It is stated that in mid-term the logging level should be decreased in order to reach the LULUCF goal, but it is not clear to which extent this should happen. In the household sector, the needed reduction of firewood use was also referred to by the need that the biomass which become available is needed by other sectors. However, it is not clear if this reduced supply will be sufficient for the needs of the different sectors.

Comprehensive supply analysis, comparison with future planned biomass demand is needed in the LTS as well

In order to ensure that there will be enough solid biomass for energy purposes, the supply analyses should sufficiently granular analyses on future planned primary forestry biomass use, and need to include other feedstocks, like non-primary woody biomass (e.g. industrial by-products, agricultural residues). Besides the carbon sink and sustainability limitations, described below in detail, assessment of non-energy demand for these feedstocks are also needed, in order to avoid any future demand conflicts. The different units of feedstocks should be converted to primary heating value, in order to be comparable with the future planned energy use.

It is a well-known issue that currently the reported biomass energy use is around two times higher than the available biomass supply by the different statistics. The BioScreen CEE project developed a detailed analysis of this gap, and also developed specific policy recommendations which could contribute to eliminating the gap between the two sides

The future impact of the sustainability criteria

Since the LTS has been published, the Renewable energy directive was revised again (EU/2023/2413). From a biomass sustainability perspective, the most important changes are that a link has been created between the planned biomass use and the LULUCF targets (see below next point), and that the biomass cascading principle was established. The cascading principle prioritizes using wood for long-lived material products, and to re-use and recycle those products as many times as possible, and only use it for energy purposes when wood would be otherwise disposed.

Integrate the long-term impact of the cascading use implementation in the LTS

Even though the directive is very generous in terms of possible derogation, for nature protection and climate purposes the adaptation of the directive should not undermine its main objective, i.e. to decrease the share of primary forestry biomass in the energy use. This is especially important for Hungary, as installations that fall within the scope of the directive are mostly (~56% of total weight) using primary forest biomass.

The use of wood and new processing technologies for long-term storage of absorbed CO_2 is also highlighted as an opportunity in the LTS.

The role of forest carbon sink

The LTS assumes that around 4,5 million tCO_2eq would be offsetted by the LULUCF sector annually in 2050, in order to reach climate neutrality. Even though it was not integrated into the final version, the draft LTS document included a detailed description of the projected carbon sequestration of existing forests and afforestation. The model used for the calculation is the same as it was used for the Hungarian Forestry Accounting Plan (CASMOFOR-NFDB). It contains three scenarios: one assuming the forest reference level (logging level would be increased to 10 million m^3/year after 2040, from current ~ 7.5 million m^3), an increased (~ 8.5 million m^3), and a lower level logging (in which the current level would remain the same). Even with the current level of logging, the projected annual sequestration would decrease to ~ 0,7 million tCO_2/y, and in case of the increased level, it would decrease further to 0,2 million tCO_2/year. For afforestation, the increased level (started in 2020 from yearly 3200 ha and then increased and maintained on annual 6100 ha yearly afforested land) would assume -1,7 million t CO_2eq annually. Therefore, the total forest land would sequester around 2,4 million to CO_2eq annually in the best case.

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The final version only includes one graph regarding the projected carbon sequestration of the sector. It assumes that because of the emission of the non-forest land use, land use change the total LULUCF sector would be slightly net emitter in 2040. However, the modeling assumptions are not described. Assuming that it is based on a BAU scenario, even the higher level of afforestation and the maintaining of current level of logging would be not sufficient to offset the above referred 4.5 million to CO_2 emission.

Unfortunately this gap is not analyzed in the document. The summary of the document mentions the need for decreasing the current logging level in mid-term, however, this need is not discussed in the dedicated chapter of the LULUCF sector. Only the SWOT analysis mentions maintaining and, if possible, increasing the CO_2 absorption capacity of the forest as an opportunity, and as threat, the significant increase in the demand for wood biomass for energy purposes.

Even though the interlink between the carbon sink of forest and the forestry biomass use is missing, the revised draft NECP uses a sub-model for the HU-TIMES model, the so-called the FOX (Forest Carbon SINK Optimization), which sets up primary energy use limits for primary solid biomass, also in light of the LULUCF targets. However, this model is not identical to the one which was used for the Hungarian Forestry Accounting Plan, developed by the Forest Research Institute. The cross-checking of the two models has not yet been done, and also it is unclear how reliable the FOX model is in the long term when it comes to non-forestry biomass sources.

Ensure that the projected need for natural sequestration can be covered, and measures are well-defined for that, including its potential limitation on biomass use.

In the revision process, the gap between the projected level of natural sequestration, and the modelled demand for carbon sequestration has to be addressed. In order to close that gap, further action plans need to be identified. It also includes the limit of available forestry biomass for energy use, as the result of the FOX model suggests.

Risk associated with high-relience on BECCS

The LTS assumes that in the long term, the firewood use on residential level will decrease only to a few PJ by 2050, but at the same time the use of biomass in the power sector will skyrocket after 2040. This increased biomass use is assumed to happen in future bioenergy power plants with carbon capture and storage technology (BECCS). The draft NECP has slightly different figures for 2050 when it comes to the planned capacity of and produced electricity by BECCS, compared to the LTS. It envisages 1.8 GW capacity, which would make this technology the third

pillar of the future electricity system: after nuclear and solar+wind, it would cover 13% of total electricity generation, while capturing 6 million t CO_2 annually.

However, there are a number of risks and disadvantages that have to be considered, which calls into question this high level of reliance on this technology. First, the technology is not proven on scale. Even though the technology has been existing on the market since 2018, these are almost exclusively bioethanol plants, where the technology is simpler and the investment costs are relatively lower, but in power plants it is only used on a demonstration scale. Currently, around 2 million t CO_2 is captured by BECCS globally, which is still insignificant on a global scale. In addition, transporting the captured carbon dioxide and storing it in geological formations is another complex technology, therefore, it is no coincidence that only half of currently captured CO_2 is stored.

In addition, the carbon capture process itself has drawbacks: in the most optimal case it can capture up to 90% of carbon-dioxide, so 10% of it is still emitted to the atmosphere, and given that the specific emissions of biomass are slightly worse than coal, this can be a significant amount overall. The positive balance is further worsened by the energy demand of the capturing process and the compression of the CO_2 being able to be transported. This loss can be very significant, various literatures put it at between 15-45%. According to the IPCC, the efficiency of a BECCS plant could be as low as 18%. In case the waste heat can be reused in district heating systems or as industrial heat, this loss could be significantly reduced, but due to economies of scale, these are likely to be large power plants. However, currently in Hungary the annual efficiency of those biomass power plants which are connected to district heating is only around 50%.

But most importantly, if long carbon cycle feedstock, like forestry biomass is used in BECCS power plants, from a climate change perspective we are only transferring the stored carbon from one pool to another. Of course the produce energy is in addition, but with the trade-off between that and the carbon emission through the value chain, the emission penalty and the low efficiency, make the technology far-not carbon negative. To address this risk, most of forestry biomass with long carbon cycle should be excluded as a potential feedstock, and only feedstocks with short carbon cycle, with respect to the cascading use principle should be used, i.e. wood by-products or wood products which are cannot be used as material anymore. Agricultural by-products (such as straw) have a short carbon cycle, but excessive use of these can lead to soil depletion and, due to their low energy density, can cost more energy to transport over long distances than the energy they produce. Energy plantations can be another source, but in that case possible land conflicts, indirect land use change and the possibility of natural restoration as an alternative has to be considered.

The FOX model assumes that from the 84 PJ of biomass which will be available for energy use in 2050, around 40% would be from forestry biomass (not including logging residues), and the remaining 60% would be from “other” sources. Besides that, hhe strategy lacks detailed analysis and information on the potentially available low-risk feedstock for the technology.

A dedicated feasibility study is needed to determine the true potential of BECCS technology, considering only feedstock with low-carbon cycle

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We recommend that forestry biomass should not be counted as potential feedstock for BECCS technology, as the sequestration of natural sinks has to be increased significantly in order to reach the climate neutrality target, and even on century-scale timeframe, using firewood for energy production even with BECCS with all the negative effects has significant negative impacts on the climate and nature compared to low-carbon renewables, such as wind and solar.

We do need industrial removals, including BECCS, but it has to be based on detailed analysis on the availability of potential feedstocks:

- wood industry by-products and wood waste, in line with the cascading use principle;
- agricultural waste, with the limitation of soil fertilizing and higher energy for transportation;
- potential energy plantations, considering possible land conflicts, indirect land use change and the possibility of natural restoration as an alternative opportunity.

Assuming the limited availability of the feedstock suitable for BECCS utilization, we recommend to use it not in the power sectors where alternatives already exist, but in hard-to-abete sectors, such as air transport or high-temperature industrial processes.

Household energy efficiency

As it was described above, the LTS assumes that the 74 PJ of firewood use on household level will drop to a few PJ until 2050. Even though there are strategic document which focus on the energy efficiency of the building stock on long term, the Long Renewal Strategy on the basis of Directive (EU) 2018/844 (LRS), it is not clear how the government would like to achieve such a dramatic shift in the firewood user households. The LTS only describes the projected energy sources change and final energy consumption in a general way, but it is not clear from the LRS either. There are no specific measures which are focusing on that aspect, but instead, it includes measures which would increase the overall biomass use, through the promotion of a biomass-fueled district heating system, or the promotion of a biomass heating system for SMEs. It also identified the loam family houses as a building type where high energy use is often accompanied by structural problems and lower residential comfort, so energy renovation may not be recouped. The strategy suggests the dismantling of these houses. This is highly relevant for the biomass use, as they are mostly heated by biomass. However, there is no measure in the document which would support the inhabitants of these houses to move to another building stock.

Predictable household energy efficiency measure, which promotes deep renovation, is needed for the firewood user households, in order to make the envisaged steep firewood use reduction happen.
The upcoming development of the National Building Renovation Plan should include

tailor-made measures for firewood user households, and ensure that they are not neglected by future funds only because biomass is labeled as renewable energy. This is associated with the requirement of a roadmap for tackling energy poverty, including targets and measurable progress indicators.