National policy brief on biomass sustainability criteria- Romania

LIFE BIO-BALANCE

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CONTENTS

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Introduction

Within the activity C2 “National policy brief on biomass sustainability criteria”, WWF partners led by the expert partners EAP and REKK will draft one national policy brief for each project country, summarizing the **alternatives to forest biomass use in the national country plan** of each of the project countries: Bulgaria, Hungary and Romania.

The partners will also brainstorm on the **forest biomass sustainability criteria** and **subsidy schemes for utilization of biomass for energy** and integrate the results of the expert **analysis on alternatives** from the country pilot sites (WP IV).

The national policy briefs will support the final policy papers with **recommendations for alternatives to forest biomass for the National Climate and Energy Plans (NECP)[1],** and **recommendations for sustainability criteria for forest biomass and subsidy programmes** which will be delivered under C2. These papers will be communicated to the national authorities in charge of the development of the NECPs (i.e. Ministry of Environment, Ministry of Energy) and to the national bodies (both ministries and executive agencies) responsible for developing subsidy programmes/schemes for biomass utilization, and in specific cases – local and/or regional authorities that run the subsidy schemes.
The partners will also disseminate the recommendations for sustainability criteria to the local and regional authorities so that they can integrate them in their local strategies and actions plans related to energy and/or environment.

[1] https://ec.europa.eu/info/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climate-plans_en

1. Context of the EU legislation and national plans and strategies

The European Union Directive on the promotion of the use of energy from renewable sources[2] (RES), recast in 2018 (referred hereinafter RED II), is an important milestone in the European renewable agenda, bringing among other, a minimum set of sustainability criteria to be considered by the Member State for biomass-based heat and power installations equal or above 20 MW. Within the present green energy agenda, the EU Green Deal[3] plays an essential role as it urges the Member States objectives for carbon neutrality.

At the same time, the newly proposed Fit to 55[4] package calls for strengthening of the current sustainability criteria, as part of the REDIII revision, by applying the existing land criteria (e.g. no-go areas) for agricultural biomass, but also for forest biomass (including primary, highly diverse forests and peatlands), by extending the criteria to installations below a total rated thermal capacity of 5 MW, and by applying the existing GHG saving thresholds for electricity, heating and cooling production from biomass fuels to existing installations (not only new installations), and further adding elements to minimize the negative impact of harvesting on soil quality and biodiversity.

On the other hand, the EU Biodiversity Strategy for 2030 Bringing nature back into our lives, released in 2020, and EU Forest Strategy for 2030, released 2021, give forests the importance they should have for biodiversity conservation and protection, while ensuring that the amount of wood used remains within the sustainability limits and is optimally obtained, in line with the cascading principle and the circular economy approach.

These should be reflected at the national level, yet in Romania there are inconsistencies between the forestry and energy sector aims and baselines, as the BioScreen CEE project country analysis report revealed. Furthermore, Romania has yet to bring forward evidence of transposing the REDII directive and given the mentioned Fit for 55 package and the recarst of the REDII directive, Romania might need to jump directly to the transposition of the REDIII directive.

At the national level, a number of important policies are in the pipeline for being developed or revised in 2022 and 2023, policies which are crucial for the planning and regulation of forest biomass use for energy. These documents include the reforms from the Romanian National Resilience and Recovery Plan, namely the development and adoption of a Decarbonization law and an Energy Law, followed by

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L2001

[3] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[4] https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

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the revision of the National Energy and Climate plan. Furthermore, a new Forest Strategy is among the reforms steaming from the NRRP, to be developed by the end of 2022. At the same time, the REPower EU Plan[5] released by the European Commission on the 18th of May, has major implications for the development of renewable energy nationally, including biomass energy production.

Regarding the existing plans and legislation, forest biomass is poorly evaluated and emphasized, as the information below shows.

The 2020 version of the National Energy Strategy[6] indicates firewood as the main form of biomass-to-energy, mentioning that it is burned in low efficient stoves. However, the strategy is lacking a scientific base and is widely criticized for its prioritization of coal and hydropower energy development. Also, it does not foresee clear plans for the use of forest biomass, for electricity production or heating, nor does it foresee clear measures for addressing the issues related to inefficient use of firewood at the household level.

The Romanian NECP[7] emphasizes the need for compliance of solid biomass (mainly firewood and agricultural waste) with sustainability criteria. As well, it foresees an increase of renewable energy sources (RES) in the heating and cooling sector, based especially on the solid biomass availability, yet being aware of the uncertainties regarding the RES allocation of certain resources, such as firewood, and the lack of clear statistics on the real potential of biomass.

Overall, the subject of biomass use in NECP is not widely addressed and the measures are ambiguous. For instance, it is foreseen the increase of forested area, but the measures of how they are going to do this are not widely addressed. It does not say how much is going to increase or how much money is going to be spent in order to do this, nor is it correlated with measures from other plans (e.g. Rural Development Plan). It says they will identify the vegetation that might be included as forests, and promote measures to forest degraded lands. An update of the indicators for sustainable forest management will take place. In addition, the plan mentions the need to adapt the forests to the climate changes (restoration of degraded forests, promoting trees that can adapt or resist to climate change etc.). The plan also states the conservation of virgin forests. But the measures are just narrative, without clear ways of implementation.

In the National Resilience and Recovery Plan[8] (NRRP), Romania has foreseen the review of the NECP. The NECP was adopted in October 2021 with a significant delay from what the EU legislation states. Even so, at the moment of adoption the plan was

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN&qid=1653033742483

[6] http://energie.gov.ro/transparenta-decizionala/strategia-energetica-a-romaniei-2019-2030-cu-perspectiva-anului-2050/

[7] https://energy.ec.europa.eu/system/files/2020-06/ro_final_necp_main_en_0.pdf

[8] https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility/recovery-and-resilience-plan-romania_en

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outdated and many of the targets, measures and data included in it have to be updated. At the moment of adoption, the Government stated very clearly that in 2023 the plan will be brought up to date.

The Government should have elaborated a new National Energy Strategy, which should have been in correlation with the NECP and the measures proposed in the strategy should be included also in the plan. Unfortunately, since 2016, there have been four different strategies, each one different from the other, with different priorities and targets from one to another. The last version was presented in November 2020, most likely for electoral reasons, as elections were taking place a month later. Since then, Romania is already at the third Government, with very low chances to see an adoption of the last draft. Also, neither the European legislation nor the national legislation foresees the obligation for the authorities to elaborate such an act. Beside that, the NRRP does not mention any actions to be taken regarding the strategy.

The NRRP has come up with a long-awaited measure, a date for phasing out coal, set for 2032. This measure is accompanied by two legislative measures: the adoption of a Decarbonization Law at the end of 2022 and a new Energy Law in 2023. A risk with the upcoming Decarbonization Law is that we might see an increase in the use of biomass for energy purposes in order to compensate for the coal phase out. Even so, both policies are an opportunity, along with the upcoming revision of the NECP to advocate for the recommendations developed in the BioScreen project.

Furthermore, the NRRP envisages a new Forest Strategy approval by the third quarter of 2022, which shall also set out the sustainability criteria for forest biomass for energy use. Moreover, it aims to diversify the energy mix in heating and cooling away from forest biomass.

2. Quantitative data regarding the use of biomass for energy purposes

BioScreen CEE project national report revealed that while comparing supply and demand side of the biomass market, a huge gap was observed, which might have several possible explanations, yet the poor availability of information makes it impossible to detect the root causes of this difference. There are fundamental differences between the applicable terminology of national statistics and the forest authority nomenclature, which adds to the technical confusion on the supply side.

The 2020 Energy Strategy underlines that the data on the production of solid biomass bears a high degree of uncertainty (about 20%), being estimated at 41 TWh (ca. 18 mil cubic meters) in 2018. On the other hand, in the annual Forest Status Report the total quantity of harvested wood in 2018 was 19 mil cubic meter, out of which only 5.55 mil cubic meters was wood fuel. On the demand side of biomass

energy, adding up the National Energy Balance Statistics figures for the Transformation sector and the final consumption sectors implies much higher wood fuel consumption - over 15 million cubic meters in 2018, for example. We estimate the supply-demand gap slightly closing over time, decreasing to 50% in 2019 from 70% in the beginning of the 2000's.

Beside that, there is a lack of clear data for agricultural waste as its potential is being estimated in the NECP between 21.5 and 35.8 mil tones.

There are several possible explanations as to what can possibly cause the gap between supply and demand statistics but the poor availability of information makes it impossible to detect the root causes of this difference.

On the supply side, another possible explanation for the gap, besides agricultural wastes, is the invisible sources, possibly covering illegal logging coming from forests, unmonitored illegal imports and waste incineration.

On the demand side, the statistical estimation methodology of household statistics is of crucial importance because this consumption category alone is bigger than the available forest wood for energy purposes on the supply side. As household statistics are based on surveys, we can assume that people mostly would not report waste-burning.

Regarding the gap, the most optimistic assumption about it would be that, eventually, it is firewood, indeed - and not waste (plastic and other materials which are much more polluting than burning firewood). But that translates to higher latent pressure on forest resources.

Once again, it needs to be highlighted that the attention should be given to the statistical data collection methodologies both on energy and forestry. It should start with the two sets of definitions for wood used for energy production (same term, different understandings, as highlighted in the BioScreen project report) and their collection methodology, which are partly responsible for the data inconsistencies related to bioenergy use. Moreover, the collection methodology for households heating does not provide overall disaggregated data for firewood, wood waste, agricultural waste.

There is also, the figure of 3.5 mil households using firewood, which has been used as a reference since 2009, and the fact that the data do not include information on public institutional buildings (which also use firewood), nor for industrial operators which use firewood for heating plants or cogeneration.

We consider that these are the main reasons behind the data inconsistencies, which are constantly used in strategic documents related to energy and forestry sectors.

Illegal logging topic might be also taken into consideration, yet it lacks clear data, while different figures are heavily discussed among stakeholder and media.

3. Policy recommendations

3.1. Policy recommendations to improve the biomass-to-energy policy-making

Recommendation 1: Synchronizing the biomass definition and data sets

There are significant **differences between data** from the energy sector collected by the National Institute of Statistics and the data from the forestry sector collected by the National Institute of Statistics and National Forestry Inventory as well as their methodologies. Another significant difference in the data sets was found in the data for forestry and energy sector within the datasets of the National Institute of Statistics which results from the varying definition of the fire wood/wood for fire and the methodology for its data collection. For example, there are differences between harvest of wood and the quantity of "missing wood" within the national inventories which needs further clarifications.

Recommendation 1 is to provide a synchronized definition of biomass-for-energy that will bridge the forestry and energy terminology; it may expand to definitions of biomass-based products and their origins. **It may be the basis** for developing a common biomass-for-energy database that encompasses the forestry features of biomass and their energetic characteristics. Such a definition as well as the creation of the database can be regulated in the upcoming Energy Law to be developed as part of the NRRP reforms.

Recommendation 2: Establish clear biomass-to-energy inventories , databases and methodologies for the national and local strategic documents

In addition to the varying datasets and their disparities, there is no specific **biomass-to-energy methodology for all beneficiaries.** This makes it difficult to anticipate the trends and create realistic evolution forecasts. So, there needs to be a verification methodology that will ensure that the biomass utilization is being conducted in a sustainable manner.

Recommendation 2 is for the establishment of clear and concise **biomass-to-energy inventories, datasets and databases** that are specialized in the biomass-to-energy utilization and conversion and may be applied in local and/or national strategic documents.

This will allow for short-, medium-, and long-term **planning of the sustainable biomass utilization** and will **support the authorities in better planning** their sustainable energy development. It will **impact the implementation and monitoring** of the Fit for 55 targets, and will overcome the issue of verification and validation of the data on national level according to the European accounting practices. Furthermore, this will support the revision process of the NECP and the

development of the first version of the Long Term Strategy, for the planning of the sustainable biomass utilization in the process of decarbonization of the energy sector, the forestry sector and the building sector (in relation to the use of firewood for heating).

Recommendation 3: Stepwise transposition of the REDII and other European best practices into the national legislation

From the EU perspective, under Fit to 55 especially, the management methods of dead wood, the forest management in the long-term and the big diversity of species are important to take into account. In this respect, Romania is close to these targets but must improve the policies and legislation enforcement and link it with existing and future climate and energy policies such as the NECP, the Long term Strategy and the future REPower EU plans.

Recommendation 3 is for stepwise transposition of the REDII or maybe directly of the REDIII directive and other European best practices into the national legislation. The transposition of the REDII is largely found in various strategic documents. Nonetheless, the implementation and the enforcement of the existing legislation is still a challenge especially in respect to illegal cutting. So, a more systematic approach and policy pipelining is needed, especially given the need to ensure legislative clarity in light of the new RES targets of the Fit for 55 package and the REPower EU plan.

Recommendation 4: Non-forestry biomass should also be considered

The discussion for biomass utilization is strongly focused on forestry biomass, whereas it is necessary to use biomass from all the sources for energy production, including agriculture. From surveys, it is known that very small percentages of the households use agricultural biomass. Another possibility is to re-use the wood residues from the furniture industry. Capitalisation of the residues to biomass products for energy needs to be investigated.

Recommendation 4 suggests that **in the biomass-based energy mix, there needs to be a precise analysis of the utilization of all types of biomass**. Its usage may not be as straightforward as the forestry one, but also needs to be inventoried and cooperation schemes for its utilization to be developed.

Recommendation 5: Alternatives to the raw firewood need to be considered

In Romania, the quantity of electricity produced from biomass is very low and at the moment it is not needed to directly address the large combustion plants, but rather the small/domestic ones producing heat energy for the households.

However, we are witnessing growing pressure from the wood industry to increase the use of biomass for electricity generation and thus, **it is critical to monitor and address such upcoming risks and advocate for a sustainable use**.

The usage of raw firewood for heating is a long-lasting tradition and needs to be carefully investigated in terms of its inter-sectoral character, needs and underlying social problem. Cases where the use of biomass cannot be prevented should be considered – i.e. small settlements that are socially segregated and deprived.

In small settlements, where there are centralized energy sources, only restrictions on the biomass products and their quality used should be placed – i.e. minimum values of moisture content, and use of pellets with high quality standard and labeling. The combustion devices need to be changed with BATs and there need to be financial incentives for this. On the other hand, a complete phase out of the wood usage is not realistic, but still can be envisaged through PVs and solar thermal technology to cover the household demands.

In big cities, households heating on firewood need to be restricted in a similar way, unless they have access to a centralized heating network. If this is the case, then they should be incentivized to switch to other energy sources. Households living in multi-family apartments cannot be incentivised for decentralized energy sources such as PVs and solar thermal technologies, unless these are common for all residents in the building.

3.2. Policy recommendations towards biomass alternatives

Recommendation 1: Develop in-depth analysis of the biomass-for-energy usage from demand side perspective

The establishment of analyses of the demand side for biomass-based energy will bridge the supply side as already discussed. A comprehensive analysis of where and how much biomass is needed to cover the energy demands of the population may provide better understanding of how the biomass usage should be restricted.

Recommendation 2: Develop intervention logic for replacing firewood usage with specific energy alternatives

There needs to be specific intervention logic for users to have their biomass-based energy replaced by other sources. As already suggested, small settlements may need their biomass energy and not be fit (socially, financially) to replace it with other energy sources. In large settlements, connection to the broader energy grid and centralized heating sources needs to be in place to conduct the replacement of the biomass-based energy.

It is reasonable to consider that in the small settlements decentralized alternatives may be considered – individual pellet boilers, PVs and solar thermal installations. It is possible to consider utilization of biomass in small-scale heating plants on chips. On the other hand, in large settlements, the users should be encouraged to

connect to the centralized heating options that provide better energy efficiency and efficacy of the energy transmission.

Recommendation 3: Develop specific pipelines for firewood phase-out in local communities

Given that the local communities have good monitoring over the energy sources of the population, firewood phase-out may be planned. Such strategic energy planning may be embedded in broader documents such as SECAPs, Energy Efficiency and RES actions plans, etc.

In the context of the proposed reforms in the Fit for 55 package, namely the introduction of a carbon price for the buildings and transport sector, there is major risk for local communities and vulnerable households to be impacted financially by the pressure to decarbonize and transition to a more efficient energy system. Therefore, it is imperative that the Romanian government addresses both the firewood dependency locally, along with the poor efficiency of firewood use, by: having up-to-date analysis of the national situation of firewood use, designing transformative support schemes for households that must enter into force before the introduction of the ETSII in order to diminish its potential impact as well as make use of the funding available in the new Modernization Fund and Social Climate Fund for the these schemes.

Recommendation 4: When alternatives are not possible, new standards and requirements needs to be in place

The long-lasting tradition of firewood usage has its own historic roots and is oftentimes linked to the limited alternative options of the population. In this respect, when the population cannot quit the use of firewood, it is needed to place new standards, requirements and even restrictions on its use.

This may cover:

- Firewood quality standard enforced – only firewood with less than 30% moisture content being sold on the market
- Financial incentives for new stoves according the BAT principles
- Regular campaigns for best practices for firewood combustion
- Regular maintenance of the small combustion devices
- Transformative support schemes in place for improving energy efficiency and switching to other energy production options (heat-pups, solar).

3.3. Policy recommendations on improving the sustainability criteria

At national level there are several silvicultural practices which can be considered as best practices, being also relevant for the EU efforts to strive for a more climate friendly approach to forest management and wood usage. Thus, there are indicated as being related to REDII criteria on harvesting legality, but also to long-term production, forest regeneration, nature protection, soil quality & biodiversity, LULUCF, the followings practices:

- long rotation management period
- management practices like uneven-aged and continuous-cover forestry
- natural forest type
- species diversity
- deadwood preservation

The **principle of continuity of timber crops in long rotation cycles** (applicable for all forest management plans) contributes to carbon sequestration and carbon pool stability. Long management cycles give the forest greater stability.

In order to apply the principle of continuity of timber crops through forest management plans, **long-term planning** is pursued (which aims at including the normalization of the production fund). It is thus planned to form and maintain a **balanced mosaic of the different stages of development for the stands** (balanced proportion of different age classes), which has direct benefits for sustaining biodiversity and with it the resilience of forest ecosystems. This is done by calculating the allowable cut by the age class method (method developed and applied in Romania), which involves sacrifices in establishing the allowable cuts (annual allowable cuts), this method being the most restrictive for most management plans (considering the structure by age classes for the forest fund).

Carbon storing is also influenced by the so-called **tranquility period** (representing a period allowing cuts only exceptionally for around **25% of the rotation period**), before starting the regeneration treatments. During this period the forest accumulates the largest amounts of wood while the annual allowable cut is considerably reduced considering that during this period there are designed/planned only sanitary feelings of one m3/ha/year. The ecosystem enters into a "**wilderness period**" of about 30 years, where a significant amount of dead wood is formed that supports biodiversity and ensures forest resilience. It is during this period when large dead wood appears (not only in terms of quantity but also the quality), enhancing soil quality and preparing it for the next generation of trees.

Natural type of forest by promoting natural regeneration, by applying appropriate silvicultural treatments, contributes to carbon pool stability and increases forest resilience, by using existing and adapted seedlings.
Integrity of the forest fund is secured by **strict limitation of forest land use change**. To change the forest land use category and take out land from the forest fund, very strict conditions are legally imposed. In this way, any reductions in forest area and thus in carbon stocks are discouraged and the surface of the forest does not decrease through various changes, so carbon sequestration is increasing. This helps forest resilience through limited changes in the forest fund area.

Stable and permanent carbon stock is ensured by **deadwood management** including a network of “aging islands”, which improves forest resilience.

The practices referred above are relevant from renewables directive perspective and fitting to the five major sustainability elements describing sustainability of forest biomass harvesting under RED II and draft RED III: legality of harvesting, forest regeneration, protected areas, soil quality and biodiversity and long term production. These five points apply to primary woody biomass coming directly out of forests and might easily be associated and hence grouped to the 3 pillars of sustainability **ecological and economic sustainability and social impacts**.

Forest regeneration which is in close relation with forest naturalness (i.e. forest landscape remains the same along with no harm to biodiversity or increases after the harvesting while improving biodiversity in the sourcing areas), maintaining soil quality and deadwood management (e.g. forbidden removal of stumps and roots, leave fine woody debris in the harvesting areas, preserve “aging islands”) refers mainly to ecological sustainability criteria. Another aim goes to leaving aside protected areas as a wood source for renewable energy, still considering the needs of forest dependent communities and combating energy poverty.

The economic sustainability criteria are directly related with guaranteeing legislative requirement for better wood control (to ensure feedstock legality, local and imports as well, and for closing the loopholes in operators the supply chain) and law enforcement (e.g. enough resources for the competent authority to conduct proper checks on either the operators or the feedstock, voluntary certification scheme). Accounts also long term production with harvests below increment, limiting the biomass subsidies or no biomass subsidy for industrial roundwood to be burned and last but not least applying cascading use of wood principle.

Furthermore, biomass harvesting for energy should consider local livelihoods and provide added benefits to local communities, while assessing impact on local communities at the sourcing base. As part of the social criteria indicators, shall be also considered (i) working conditions monitoring, (ii) enable third party rights, (iii)

ensure forest dependent communities access to resources and critical services provided by the forests, and (iv) consider local socioeconomic development objectives and ecosystem services, which can strengthen and diversify the local economy.

Summarizing likewise, there are some country specificities that should be taken into account when developing further sustainability criteria:

1. forest biomass should come only from responsible forest management that follows high sustainability standards and avoids identified risk areas for illegal logging and forest degradation;
2. harvesting must be adequately determined and monitored based on transparent processes, along with the provisions of forest management plans, as the competition between the traditional forest-based industry, the needs of local communities and the bioenergy sector will inevitably increase the pressure on forest ecosystems;
3. set additional sustainability criteria to all biomass to energy plants claiming green certificates, regardless of production capacity without any threshold, to avoid creating perverse incentives that can lead to a market distortion;
4. reducing at minimum subsidizing biomass to produce energy in industrial installations, which significantly impact the wood market and thus further increase the competition for wood resources and include a robust social component to ensure that the livelihood of local communities dependent on forest resources is not affected by the procurement policies of biomass-to-energy plants;
5. pragmatic rules are needed to optimise beforeall the use of wood in line with the cascading principle in products that are of highest value for carbon storage and to ensure that bioenergy used offers real climate and socio-economic benefits, without harming biodiversity and the livelihoods of forest- dependent local communities.

3.4. Scenarios for reducing the biomass use for energy purposes

This chapter will emphasize, on one hand, the result of a scenario modeling conducted using the EU Calculator for reaching net-zero greenhouse gas emission by 2050 in Romania and, on the other hand, results of the alternative scenario mapping in local municipalities selected as part of the project activities in Romania.

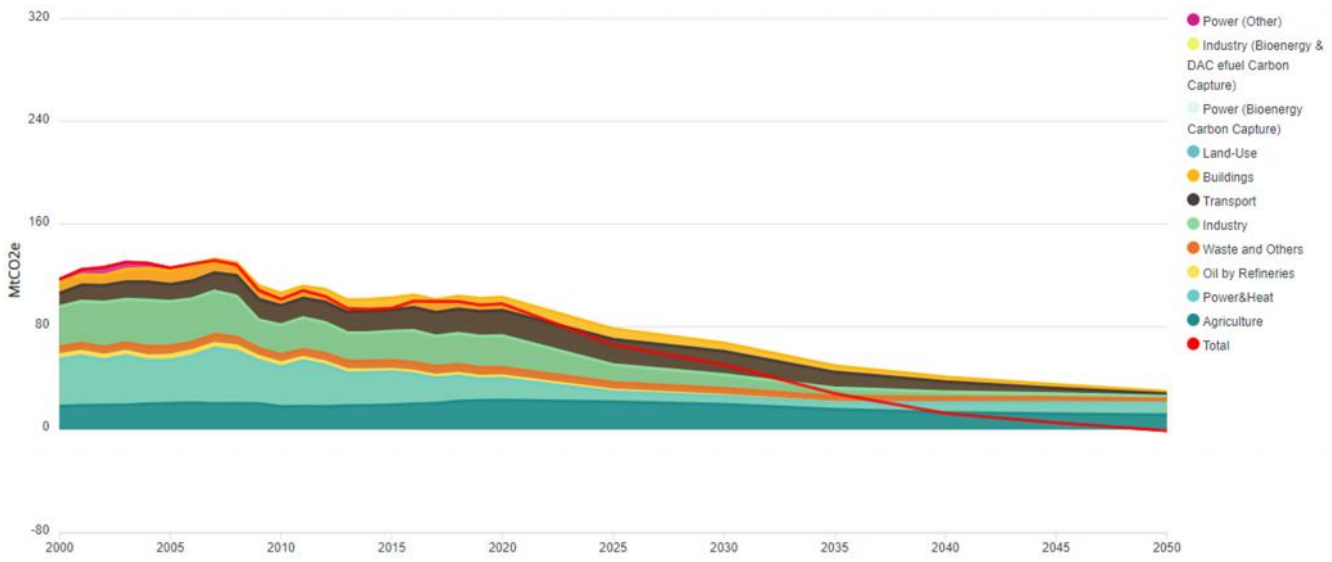
3.4.1 Biomass role in reaching net-zero emissions by 2050

At EU level, the 55% emissions reduction target for 2030 will likely necessitate a 38-40% share of renewables in total final energy consumption. Moreover, the specific measures to be taken for reaching the new targets need to be more adequately explained and quantified, in order to understand their impact and their ability to

contribute to Romania's decarbonisation efforts. A rigorous modeling exercise is mandatory for such an endeavor, in contrast with the methodology used for elaborating Romania's current NECP.

The information below is based on a scenario (external consultant scenario, after the name of the consulacy that has conducted the study) that entails a balanced approach relying on a combination of more moderate transformation when it comes to technological development and behavioral changes among the general populations.

Total GHG emissions by sector



Source: Climact, 2050 Pathways Explorer

As energy and industry are the largest current GHG emitters, it is not surprising that in order to attain net zero these sectors must go through deep transformations. According to the external consultant scenario derived using the Calculator, GHG emissions associated with energy supply would need to be reduced by 36 Mt CO2 eq. and by 20 Mt CO2 eq. in industry.

Achieving climate neutrality in the external consultant scenario also relies on changes in individual behavior through the shift to energy efficient housing and living, as well as the general switch to electric vehicles. Emissions in buildings would have to be reduced by 80% and in transport by almost 90%.

The main vector for decarbonisation will be the increased direct electrification of end-uses. To reflect this, in the external consultant net-zero scenario there is foreseen: 1. A reduction in biofuels can be explained by the switch in heating and cooking from low efficiency wood burning stoves to heat pumps and electricity. 2. Further reductions of energy demand will be made possible by renovation of residential buildings. Final energy demand for heat production remains at the same level. Even

if district heating is planned to [slightly] expand, investments in district heating efficiency and buildings energy efficiency will ultimately reduce the energy needed. 3. Energy production - Biomass and waste plants for electricity do not develop until 2050. Solid biomass, biogas and liquid biofuels are not seen as playing a role in electricity generation by 2050.

When it comes to housing, Romania has the highest overcrowding rate in the EU (45.8% in 2019). Solid biofuel was used in 2015 as the main fuel for space heating in 70% of the single-family detached homes in the country. The potential reduction of energy demand in these homes is significant judging by the fact that wood burning stoves have a very low efficiency. Moreover, the residential buildings equipped with this old technology most likely also have a very low energy performance. In 2020 more than half of the total population used natural gas for heating or was connected to district heating systems burning fossil fuels (mostly fossil gas).

GHG emissions per vector in buildings (MtCO2 eq.)	2015	2030	2050
Electricity	0	0	0
Solid coal	0.14	0.08	0.02
Solid biofuel	1.17	1	0.67
Liquid oil	1.37	0.85	0.07
Liquid biofuel	0	0	0
Liquid efuel	0	0	0
Natural gas	6.72	4.53	1.08
Biomethane	0	0.05	0.03
Gas efuel	0	0	0
Hydrogen	0	0	0
Ambiant	0	0	0
TOTAL	9.4	6.51	1.87

Final energy demand in buildings by end-use (TWh)	2015	2030	2050
Servers	0.99	0.95	0.79
Appliances	8.04	9.33	7.65
Cooking	11.48	11.87	11.71
Cooling	0.43	3.78	1.28
Heating	56.31	47.91	32.03
District heating	8.36	9.01	9.79
Hot water	13.59	15.72	15.18
Lighting	3.43	2.71	1.18
Others	3.82	2.49	0.08
Ventilation	0	1.69	3.41
TOTAL	106.45	105.46	83.9

Source: Climact, 2050 Pathways Explorer

Solid biofuel still plays an important role in 2050 in the external consultant scenario[9]. The model predicts a reduction by almost a half of biomass needed, from 35.5 TWh in 2015 to 19.6 TWh. This evolution is not far-fetched if one considers the highly inefficient use of firewood in 2015, burnt in stoves located in buildings mostly with very little thermal insulation. Add to this the projected reduction of population by 25%

[9] external consultant scenario for decarbonization of the building sector: Assumes an increase of 40% of per capita living space by 2050. The population will heat their homes to 23°C and cool them to 19°C; Renovation rate is kept at a rate of 1.5% per year (compared to 1.4% in 2015) until 2050; District heating expands from 16.95% of all households in 2015 to 18% in 2050. Having in mind the forecasted population decrease, in absolute terms this would actually mean less households connected to district heating networks in 2050; Hot water demand per household is assumed to remain about the same (1700 kwh/ dwelling in 2050 vs. 1641 kwh/dwelling in 2015); Major increase in the percentage of residential buildings equipped with cooling systems (60% in 2050 vs 1.5% in 2015); 60% usage of heat pumps for space heating and 53% for hot water production. This percentage does not apply to all homes, but only to the ones that are not covered by district heating and by solid biomass-based individual heating systems; Combining energy efficiency in buildings with the shift to electrification of heating will remove the need for much of the natural gas and, consequently, the GHG emissions.

and the scenario of halving the biomass needed for heating in 2050 does not seem impossible to achieve.

The information presented so far in this chapter based on a scientifically endorsed modeling tool of decarbonization pathways, clearly shows that solid biomass for energy production will not increase in the moderate scenarios and that a combination of sound measures are needed to reduce household dependency of solid biomass, namely the electrification of heating systems and keeping a constant renovation rate until 2050.

3.4.2 Alternative energy scenarios for improving local energy efficiency

As part of the BioScreen CEE project, two local municipalities, Lapus and Baiut, have been selected for the purpose of researching alternative energy generation options to decrease dependency of firewood and increase efficiency of firewood use. For the purpose of the study, four scenarios have been assessed and compared with the baseline scenario (i.e. the current biomass use for energy in the two municipalities):

- Alternative Scenario I. Improved biomass efficiency and biomass-for-energy use (Dry wood scenario) aims at preserving the old stoves in use whilst improving the dryness of the wood use.
- Alternative Scenario II. Improved biomass utilization and use (Pellet stove scenario) aims using pellets instead of firewood and investing in new heating devices.
- Alternative scenario III. Deployment of highly energy efficient biomass burning stoves (Natural gas and pellets scenario) aims at replacing the old stoves with new pellet stoves and replacing the use of raw wood with pellets; where possible shift to natural gas will happen. The energy use in the two municipalities will be split between natural gas usage and pellets
- Alternative Scenario IV. Deployment of RE generation capacities (Natural gas and PV scenario) aims at replacing the old stoves with photovoltaic (PV) and solar thermal generation facilities for electricity for heat and domestic use and hot water for domestic use; where possible shift to natural gas will happen.

Further, the paper will present the main findings of the four assessed scenarios which propose to gradually reduce the wood use and decrease its intensity in the final heating consumption and a first attempt of drawing a set of recommendations for policy makers nationally.

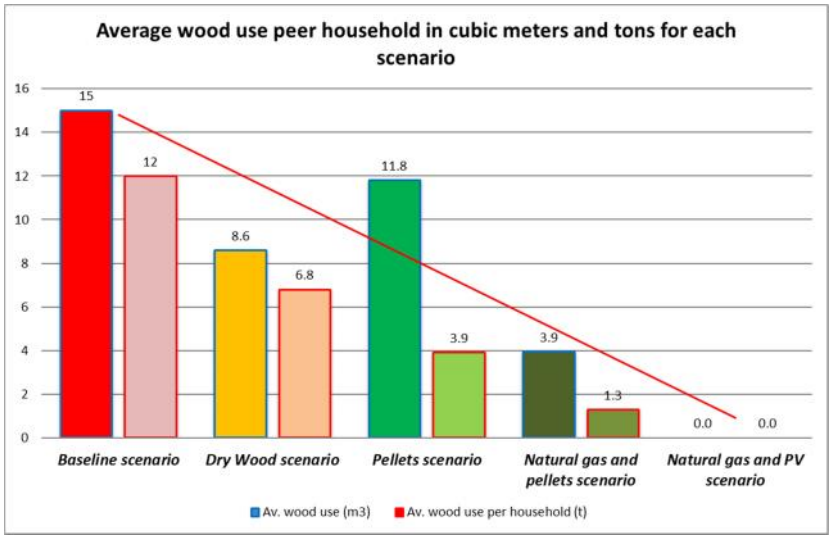
The Dry Wood scenario and Pellets scenario discuss the use of improved wood.

In the **Dry Wood scenario**, the firewood used is with lower moisture content which will improve its combustion properties. A local procurement policy may ensure the implementation of the scenario, based mainly on storing the wood harvested and cut as firewood in a dry place for at least a season before its use. If

enforced, the **Dry Wood scenario may bring up to 43% reduction in the wood dependency** for two municipalities and **a reduction of 8 306 tons of firewood**. The environmental impacts calculated for the Dry Wood scenario suggest that the values for the two municipalities will change slightly as the lower moisture content of the firewood will bring an improved burning process and reduced demand for firewood The scenario will propose lower CO2 and PM10 emissions, but increased NOx.

In the **Pellets scenario**, it is expected that the market provision of the firewood will be replaced by a biomass product that has improved energetic value and is often subject to quality certification which will ensure its calorific values and added market value. The implementation of this scenario is a subject of **market transformation** rather than local policy enforcement like in the Dry Wood scenario and so it will take more time for the shift to make change. The **Pellets scenario may bring 19 788 tons of wood saved, which is 68% reduction** compared to the Baseline scenario. The scenario will have zero CO2 emissions due to the carbon neutrality of the sustainable biomass fuels according to the IPCC emission guideline. The air pollutants will be significantly reduced, because of the efficiency of the pellet stoves and boilers that achieve complete combustion and do not emit particulate matter.

The **Natural gas and pellets scenario** combines replacement of the current firewood use with advanced biomass and the introduction of a new fuel source that will fully replace the wood use. Currently, the two municipalities do not have gas infrastructure and network so the investment in it will take significantly longer as well as the investment in individual gas boilers. Regarding the use of pellets, it will also start from scratch as stated in the previous scenario and will need time to unfold. In comparison to natural gas usage, it will not cause CO2 emissions and will have minor impacts on air pollution. The **Natural gas and pellets scenario will bring about 28 536 tons of wood save which is 97%** of the Baseline which will mostly be due to the natural gas deployment.



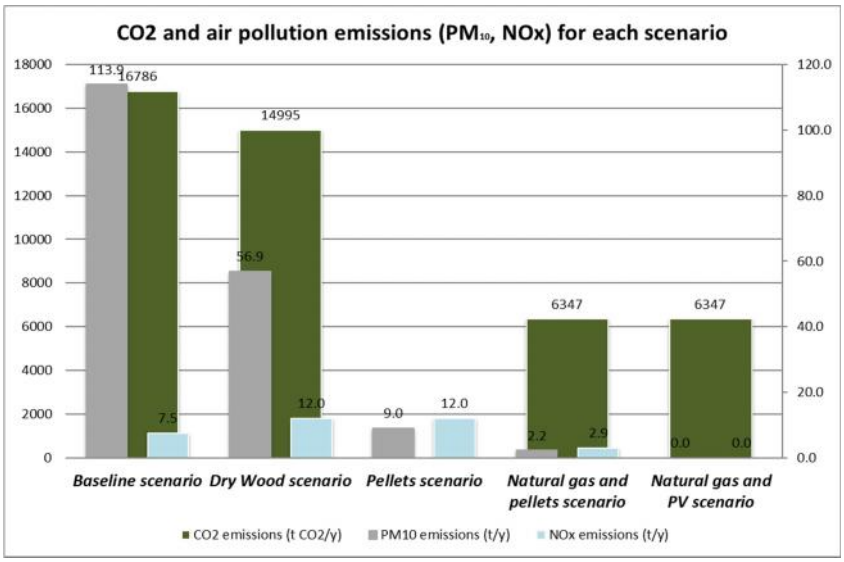
The **Natural gas and PV scenario will fully mitigate the wood use and its environmental impacts**. The PVe deployment will promote energy independence and the active role of the customers on the

energy market, i.e. as self-consumers and/or prosumers. In order for the households to fully unfold their potential to be on the energy market, the national legislation needs to allow it – these legislative changes will take a significant amount of time and effort and their procurement will be too slow to cut the dependency on wood as per the cities' objectives. This scenario is not possible to implement unless there is an external financing scheme for the households.

The charts below summarizes findings from the four assessed scenarios (Source: BioScreen CEE project Expert case studies on alternative energy scenarios).

It can be easily noticed that both from the perspective of the environmental impact (CO2 and PM emissions) and the perspective of changes in wood use and final energy use, the pallet scenario presents a considerable advantage.

The comparison of the different scenarios shows that the wood saved progresses with the levels of deployment of advanced biomass and the scenarios that fully dismiss the biomass. The Dry Wood scenario offers 43% reduction of the wood use only through policy implementation whereas the Pellets scenario provides 68% reduction of the wood use, but requires investment and market makeover. The first mixed scenario - natural gas and pellets - envisages significant reduction in the number of households using wood-based products for heating (75% less households). Thus, the proposed wood use will be reduced by 97% in total, partially as full mitigation of the wood use and by optimizing the calorific quality of the wood use. In the case of the last scenario, the natural gas and PVs fully replace the wood use and mitigate its environmental effects.



In all scenarios, the energy bill is likely to increase and the reimbursement rates for additional heating devices or infrastructure will be long unless a subsidy is applied.

To summarize the findings from the alternative scenarios for local communities, due to the rising natural gas prices and the EU-wide phase-out of natural gas, scenario III and IV seems unrealistic in terms of their policy implementation and market potential. It is expected that the number of households who would like to switch to natural gas will decrease and other alternatives will be sought, while the use of advanced

biomass is the closest and potentially the best alternative to the traditional firewood usage. However, it must first be acknowledged that the studies have not taken into consideration a series of particular aspects such as: the local specificities including accessibility of gas infrastructure for each household, the access to pallets on the local market, energy efficiency of households and possible extra contribution of insolation activities for households. Furthermore, new scenarios can be added and studies such as installing heat pumps and/or district co-generation facilities. Such local specificities are crucial for assessing and deciding on the best option for each municipality.

Therefore, the following recommendations can be made:

- A combination of short, medium and long-term options have to be regulated and made available to households dependent on firewood. At the same time, for each type of option, different support schemes can be designed, depending on the cost and need to incentivize.
- Short term options can include legal obligations for procuring and using only firewood with low moisture content. For such a provision, support might be provided to public and private entities supplying firewood for a transition period. However, no grounds can be found for support schemes for households for purchasing firewood with a lower moisture content. At the same time, implementing such schemes might require extensive information campaigns for affected populations.
- Another set of short term measures can include easily accessible financial schemes for isolating houses among low income populations, combined with micro-finance for medium and high income households.
- Medium term schemes can include support schemes for purchasing highly efficient burning stoves for pellets, available to both low and medium income households. However, these measures should be made available for households that for technical or financial reasons cannot switch to better alternatives, such as district co-generation or installation of heat pumps and solar panels.
- Medium term schemes should also provide and prioritize support for installing heat-pumps, including district heat-pumps and solar farms, for communities highly dependent on firewood as well as for sub-urban areas as an alternative to connecting to the gas infrastructure.
- Long-term schemes and provisions can be designed with the purpose of switching households using individual gas boilers to more energy efficient and environmentally friendly options, including district heating, heat pumps and solar panels. Such schemes should be in line with the need to phase out gas consumption until 2050 or sooner and should be based on country-wide assessments of the priority areas and buildings for making the switch.

3.5. Summary of the policy recommendations

The forest biomass context in Romania reveals a complexity of aspects, starting with the difficulties in accurately assessing the market, the multiple layers of regulation which govern the sector, and the multitude of stakes involved in any designed approach aimed at improving the sector's sustainability or addressing the mentioned complexities at a minimum.

Although the present document is comprehensive in its attempt to address the mentioned challenges through specific recommendations, a prioritization of possible immediate actions is required, in order to efficiently engage in upcoming policy revisions, such as the Forest Strategy, the Energy Law, the NECP and LTS.

First and foremost, policy-makers must agree on the need to systematically address the elephant in the energy sector, namely the unsustainable use of forest biomass, both at a utility and household level, each with its own specificities. A recognition of both the structural issues related to data inconsistency and reporting as well as a recognition of the risks of increasing pressures on forests as a result of the energy transition is needed, for laying down such a systematic approach.

Second, following a recognition of the issues in the sectors, policy-makers must agree upon and enable an exercise for:

1. alignment of statistical definitions and data across national institutions to allow for setting accurate baselines, reporting and monitoring. In this way, upcoming energy sector policy plannings such as the NECP, the LTS will be based on accurate baselines for effective future planning.

2. modeling decarbonization scenarios for the energy sector, including calculations on the role of biomass for reaching climate targets, namely increasing the share of renewable energy by 50% by 2030 and reaching climate neutrality by 2050. Such scenarios refer both to the pathways of decarbonization for the energy sector and for the decarbonization and energy transition of households. As the date in the chapter above shows, based on EU Calculator modeling, forest biomass continues to be present in the energy mix by 2030 but does not play a role in reaching climate neutrality, other less contested renewable energy sources, namely solar, wind and hydrogen, being instrumental for decarbonization, as well as heat pumps for the residential sector.

3. policy makers must align national legislation with the upcoming EU policy provision, and the current negotiations on the Fit for 55 package provide strong signals for Member States. In this sense, as the project findings also recommends, there is a need for strengthening the sustainability criteria for forest biomass, such as through the introduction of stronger cascade use of wood principles, allowing only for fine woody debris to be considered eligible for the purpose of renewable energy and heat generation, and to improve

subsequent regulatory provisions, such as the introduction of certification schemes for firewood. Further medium and long-term measures can address loopholes and risks associated with the strengthening of the sustainability criteria, measures which have to include support schemes for energy transition at the household level.