A III.4. Regional Policy Brief

on biomass sustainability criteria and biomass alternatives

BIO SCREEN CEE

Bio Screen CEE project

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Consortium

Co-financed by:

The current document “A III.4. Regional Policy Brief” is developed by the Bio Screen CEE project co-financed by the European Climate Initiative (EUKI). EUKI is a project financing instrument by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Its implementation is supported by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. It is the overarching goal of the EUKI to foster climate cooperation within the European Union (EU) in order to mitigate greenhouse gas emissions.

Welcome to Bio Screen CEE

The project will advance evidence-based knowledge and policy implementation of the energy sector in Romania, Bulgaria and Hungary to alleviate energy demand growth and dependency on forestry biomass for energy, especially as a result of the coal transition.

The project reviews biomass strategies and underlying data defined within national energy and climate plans (NECP) and seeks to improve the capacity and engagement of stakeholders to embrace alternatives to forest biomass and apply stricter sustainability criteria beyond that prescribed in the Renewable Energy Directive II (RED II). It will recommend specific pilot projects for local municipalities dependent on firewood that can then be advocated at the national level.

Scope

Within Activity A.III.4. “Regional Policy Brief”, we provide a condensed summary of the Project’s findings and messages to and about the policy context of forest-based biomass energy. This Brief is based on the three Country Studies and the Regional Report produced in the Project – see project files for the more detailed studies.

The current document discusses the biomass sustainability criteria as defined by the REDII and focuses specifically on forest biomass for residential heating. The document provides supporting arguments as well as proposals for improvement of the European and national legislations in terms of their utilisation of forest biomass for energy in the residential sector.

Contents

I. Policy background and European legislation and regulations on biomass use

European context of the REDII and its transposition in the CEE

The European Union Directive on the promotion of the use of energy from renewable sources 2018/2001/EU, recast in 2018 (referred hereinafter RED II), was an important milestone in the European renewable agenda, bringing among others, a minimum set of sustainability criteria to be considered by the Member State for the biomass utilisation. The directive sets the EU binding targets of at least 32% of EU energy consumption to be renewable by 2030. It provides general guidance on the sustainability criteria for biofuels, esp. lower GHG emissions, and mainstreams the use of renewable energy systems in the heating sector. RED II specifies that advanced biofuels produced from feedstocks should meet a 70% GHG emission saving requirement starting in 2021.

In 2021, a new proposal for the revision of the REDII as part of the “Delivering on the European Green Deal” package seeks to accelerate the take-up of renewables across the EU reaching a net reduction of the greenhouse gas emissions by at least 55% by 2030 – and ultimately becoming climate neutral by 2050. Thus, there is an increase of the current EU target of ‘at least 32%’ of renewable energy sources in the overall energy mix to at least 40% by 2030, which represents doubling the current renewables share of 19.7% in just a decade. In addition, the REPower EU Plan has major implications on the development of renewable energy nationally, including biomass energy production.

At the same time, the newly proposed Fit to 55 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.

Despite the ambitious EU and national plans and targets for increase in the RES use, incl. biomass, there needs to be a clear recognition of strict criteria and regulations under which the biomass is being harvested, processed and utilised. The National Energy and Climate Plans need to provide safeguards that the biomass concerned in the RES targets is being utilised in the best way possible – namely, supply is being fully ensured through strong REDII criteria and the demand is ensured through high quality biomass under strict quality certification schemes and combustion is being conducted in highly efficient and non-polluting stoves. Incentives for low quality biomass products for heating (firewood, pellets, briquettes,

etc.) are not in place. Additional monitoring actions are also proposed – such as chimney sweep programmes, burn right campaigns, etc. These recommendations will further be discussed in this document.

Harvesting criteria – RED II, Article 29(6)

The country in which forest biomass was harvested has national or sub-national laws applicable in the harvest area as well as monitoring and enforcement systems in place ensuring the following criteria for sustainable harvesting:

- Legality of harvesting operations
- Forest regeneration of harvested areas
- Areas designated by international or national law, or by the relevant competent authority for nature protection purposes, including wetlands and peatlands
- Harvesting is carried out considering maintenance of soil quality and biodiversity with the aim of minimising negative impacts
- Long-term production capacity of forests.

LULUCF criteria – RED II. Article 29(7)

Economic operators need to ensure that the following criteria are met from the country of origin:

- the country is a Party of the Paris Agreement, and has submitted a nationally determined contribution (NDC) to the UNFCCC, covering emissions and removals from the LULUCF sector, and
- has legislation in place to conserve and enhance carbon stocks and sinks and providing evidence that reported LULUCF-sector emissions do not exceed removals.

Efficiency criteria – RED II. Article 29(11)

The efficiency criteria set efficiency standards for new power plant, with the following ranges and minimum efficiency:

- no efficiency requirement for new plants of less than 50 MW thermal capacity
- for installations with a capacity of 50 - 100 MW, high-efficiency cogeneration, or in the case of cogeneration is not cost-effective (electricity-only mode), meeting the best available techniques requirements
- for new plants above 100 MW, cogeneration, or efficiency of at least 36% in the case of cogeneration is not cost-effective
- no requirement for power plants applying biomass CO_2 capture and storage (CCUS).

GHG criteria – RED II. Article 29(10)

RED II. requires accounting for CO_2 emission from fossil fuels burned during biomass harvesting, manufacturing, and transport, as well as non-CO_2 emissions from biomass combustion.

Calculated emissions are compared to the following standard values:

- 80 g CO_2eq/MJ for heat,
- 183 g CO_2eq/MJ for electricity
- for heating, in the case of coal substitution, the comparator is 124 g CO_2eq/MJ.

Dedicated criteria for agricultural biomass – RED II. Article 29(2) and 29(3)

- Operators or national authorities have monitoring or management plans in place to address the impacts on soil quality and soil carbon. Information about how those impacts are monitored and managed shall be reported.
- Agricultural biomass should not have originated from land which was (before 2008) primary of highly biodiverse forest or other wooded land, or land designated to nature protection purposes of highly biodiverse grassland.

Figure 1 Summary of the related section of Article 29 of the RED II

National forest strategies

During our analysis of the Bulgarian, Hungarian and Romanian national forest strategies we identified some important shortcomings that all three countries have in common. Addressing these issues is important to enable a sustainable forestry sector that aims at serving climate, natural conservation and energy goals as well.

1. *Supply-demand gap - The main shortcoming identified in the national strategic documents of the three countries was the failure to explicitly address the gap between the officially accounted firewood production and the biomass energy consumption data. Stipulating growth in biomass energy demand without making sure the sustainability for the supply is a major policy failure.*
2. *Sustainability complexity – Sustainability is mostly interpreted as a forestry management term, meaning that annual wood harvest shall not exceed annual volume increment of the forests. This, being a valid operational rule of thumb at the management level, however, shall not be applied for planning at the national policy level. The concept of sustainability must be enhanced with ecological dimensions to make sure biodiversity aspects are properly acknowledged in the national strategic planning and policy implementation.*
3. *Climate policy integration – All the three countries plan for carbon sequestration by their existing forests but fail to integrate that into their explicit climate mitigation strategy. The carbon sequestration by forests is accounted for based on existing forest plans without considering carbon pricing. This not only leads to socially cost-inefficient climate policy but fails to exploit the carbon sinking potential of the forest sector.*

It is recommended that governments in the three countries address the above considerations during the 2023-2024 revision process of the National Energy and Climate Plans.

National energy strategies

The three countries have different attitudes and strategies for biomass-based energy production. While Hungary and Bulgaria envision significant growth in biomass consumption of approximately 35% and 25% by 2030, in Romania it is marginal. If measures are put in place to realize these targets, a growing practice of biomass and coal co-firing will put pressure on biomass resources in the next decade.

For all three countries air pollution is the motivating factor for reducing residential firewood consumption rather than the sustainability of biomass resources, yet they face infringement procedures for failure to comply with EU clean air regulation. While cases against Romania and Bulgaria are ongoing, in February 2021 the European Court of Justice ruled that Hungary broke EU law on ambient air quality by systematically and persistently exceeding the daily limit value for particulate matter PM10. Bulgaria faces the same allegation, while Romania is being filed for failing to adopt a national air pollution control programme.

II. Solid biomass consumption trends

Biomass is the most widely used renewable energy resource in these three countries. The majority of solid biomass is used for household heating, but it is remarkable also in district heating. Yet, in Hungary and Bulgaria, the transformation sector has proved to be easily burning industrial amounts of wood for energy if policy measures directly or indirectly provide incentives for that. Dedicated biomass heating plants and co-firing of biomass in coal power plants might result in an extraordinary leap in demand for forest biomass.

Two factors have emerged recently to surge consumption trends: the unfolding energy crisis in the short run and the emerging technology of biomass energy with carbon sequestration and storage in the long run.

The energy crisis started with a substantial demand boom after the pandemic and, before reaching a new equilibrium, it has been seriously aggravated by Russia's war on Ukraine. As European member states prepare for natural gas shortages in the coming winter, governments rush to amplify firewood supplies often without any long-term sustainability consideration.

Parallel to that, climate friendly technologies develop rapidly. In the long-term climate strategies, there are high hopes to biomass energy plants equipped with carbon capture and storage adding potentially industrial amounts to current levels of biomass energy consumption.

Sustainability regulations[1]

Sustainability in the forestry sector is assured by forestry regulations in all three analysed countries. Hungary and Romania went beyond sustainable harvesting levels, taking into account the biodiversity of forests.

Such measures are, however, often missing for biomass-to-energy, with the exception of Hungary. Still, in Hungary the standards only apply to plants receiving financial support and have weak control mechanisms. For now, households, district heating and industry remain outside of any sustainability criteria in all three countries. In fact, the EU has not defined sustainable criteria for households, leaving the eco-design regulation for furnaces the only regulatory factor to improve efficiency. In Bulgaria and Hungary there were efforts to inform households about the proper use of firewood to minimize air pollution.

4. *While regulations assuring sustainability on the supply side of solid biomass fuels is key, they need to be accompanied by demand side legislation to prevent the use of unregulated biomass sources for energy production (e.g. imported biomass or non-forest biomass).*

RED II aims to strengthen the sustainability criteria for biomass by including efficiency and GHG emissions criteria on the energy demand side while also setting criteria for agricultural biomass on the supply side. It has been speculated that uncertainty surrounding the Fit for 55 proposal is the reason behind several Member States failing to transpose RED II by the deadline while awaiting and expecting stricter rules to emerge.

[1] This section is based on our research finalised in Autumn 2021.

Certification schemes

Effective schemes that assure and verify the sustainable use of solid biomass fuels are rare in all the three countries. Certification schemes for renewable energy are linked to financial RES support schemes, which is a sliver of total biomass use. In Bulgaria and Romania, the certificates of origin are obligatory, but not subject to any criteria regarding the source or sustainability of solid biomass. In Hungary biomass energy support schemes require biomass plant operators to prove conformity with applicable regulations. These require that woody biomass is sourced sustainably and legally, and it is not block-wood or higher quality wood. Despite these requirements, the practice of self-reporting and weak control mechanisms do not effectively safeguard the sustainability of biomass sources in Hungary.

We also see a risk of circumvention of sustainability rules if biomass is burned on a market basis, i.e. not under support schemes.

5. *Tracking schemes of timber (as requested by the EUTR Regulation) need to be strengthened in the three countries, to be able to keep track of the value chain of solid biomass fuels and to gain data on the amounts and volumes of traded biomass.*

The prerequisites for effective certification and verification schemes are clearly defined sustainability criteria, tracking mechanisms for all types of solid biomass (not only forest), responsible authorities with effective control mechanisms, and more transparent, publicly available information and data.

Support schemes

Although Hungary and Bulgaria have relatively ambitious targets for biomass-based energy production, adequate support schemes are missing. Some partial coal and lignite fuel switching is happening and conceivable on a market basis, due to rising CO_2 quota prices, as evident in Bulgaria, but the negative fuel price makes the incineration of biomass-containing waste more economic compared to firewood. In Hungary the growth of waste mixing is attributable to reducing fuel costs.

District heating systems are supported mostly through European structural funds in all the three countries, but there is no targeted operational support for biomass-to-heat.

Bulgaria and Romania support low-income households regardless of heating fuel while Hungary applies regulated prices supplemented with social support in small municipalities for the direct purchase of firewood or lignite. Air pollution concerns are a limiting factor for household biomass use in all three countries.

6. Policy makers need to take the cautious approach before further enhancing biomass-to-energy support schemes. The limited availability of firewood, the low energy efficiency of electricity-only biomass power plants, the unexplained gap between supply and consumption statistics and the high dependence of low-income households on firewood all suggest that industrial scale combustion of more firewood should not be a priority.

Integrating forest wood supply data and demand for biomass energy data

Our quantitative analysis has revealed a significant gap between biomass sources supplied and biomass consumed in the energy sector for all the three countries, with Bulgaria's starting later.

Uncertainty of supply and demand statistics, which at times are estimated or missing, will go a long way to explaining the discrepancy, with no bias to credibility of either data sources. Explaining the entire gap will require elimination of errors and misapprehensions on both sides, supply - demand alike.

On the supply side, official statistics are mostly available for fuel wood categories sourced from forests covered by the national forestry code. The net import balance statistics are also methodologically consistent. Illegal logging, energy plantations, lands with tree cover not qualifying forestland, agricultural waste products and by-products tend to fall outside of the scope of forestry laws and are represented in national statistic on an ad-hoc manner. Even filling in with expert estimates of the missing data still leaves a consistently wide gap, making it inevitable for the policy to step in and improve reliability of official statistics.

On the demand side, data on biomass co-firing with coal and/or waste derived fuels tend to be incomplete. One reason is that authorities are hesitant to scrutinize the quantity and sustainability of solid biomass used for heat and power. Where it is most prevalent for all three countries in the household sector, rigorous statistical methods are executed from large samples. Yet, the lack of methodological coordination makes it very difficult to assess the margins of the statistics.

Estimating the regional economic supply potential of forest carbon sequestration

During the BIO SCREEN-CEE project, REKK has developed a bio-economic model of Forest Carbon Sink Optimization (FOX) applied to Hungary and Romania, with the Bulgarian model suspended pending data acquisition.[2]

The most important finding is that forest management, assumed to reflect economic optimisation by forest managers before carbon payments are introduced, can easily be adapted to optimize with positive and/or negative carbon payments involved. Furthermore, carbon payments substantially influence forest management decisions and, consequently, the annual volume of carbon sequestration and the total carbon stock. Forests will keep producing all the three basic product segments - sawlogs, pulpwood and firewood - even with elevated, positive carbon prices.

Romania and Hungary exhibit remarkable differences in their response to carbon prices:

- Hungary's forest stock is rapidly approaching maturity for felling, so relatively low carbon prices are sufficient to reduce intensive harvesting. The forest sector can

[2] The detailed description of the model can be found in deliverable A I.3. - Regional Report.

contribute significantly to the national abatement of 60 million tons of CO_2 emissions over the next 3 decades at a relatively low cost.

- Hungarian forests can sink 5 – 8 million tons of additional CO_2 on top of the Reference Scenario, more than doubling net annual sinking over the past decade to reach 9 – 13 million tons of CO_2. This represents 14% - 20% of the 64.4 million tons of total GHG emissions in 2019 (without Memo Items and LULUCF).
- The vast Romanian forest sector is more diverse, robust in annual increments, and less intensively harvested, making forestry carbon sinking robust even without carbon pricing. Thus, strong carbon prices (min. 60 EUR/tCO_2) would be needed to increase carbon sinking further, though this is equivalent to current industrial ETS prices.
- A CO_2 price of 60 EUR/t or higher triggers a dramatic boom in Romanian carbon sequestration. With one of largest forest sectors in the EU, Romania can use forest carbon pricing to keep its natural resource from declining. It also represents a comparative advantage for Romania, meaning it could sell the surplus carbon sinking to other European countries where carbon abatement is more costly.

7. Explicit carbon pricing would enhance carbon sequestration by the forests of the analysed countries, resulting significant biodiversity benefits as well.
8. Integrating forests by carbon pricing into climate policy can deliver emission targets at lower cost making national climate action much more socially cost-efficient.

FOX results are policy oriented. They can be used to assess the range of carbon payments necessary to trigger sufficient carbon sinking to meet more ambitious EU 2030 climate targets under the Fit-for-55 package (COM/2021/554). For now, the Commission has tabled its strategic views on carbon sequestration pricing.

- All three countries have got carbon sequestration targets that are mostly ambitious compared to current levels of carbon removals and forest reference levels (FRL) projected by NFAPs. The national targets proposed by the Commission: Bulgaria: -9.7 mtCO_2eq, Hungary: -5.7 mtCO_2eq, Romania: -25.7 mtCO_2eq.
- FOX can estimate the marginal cost of meeting these national targets based on the potential of existing forests in each country.
- If demand elasticity is introduced later in the development of the FOX model, it can analyse the effects of induced carbon sinking by means of forest carbon pricing on product markets.

We strongly believe that the results presented in our study convince stakeholders to use FOX as a new policy analytical tool. It will continue to be developed with the acquisition of more reliable input data including FOX can be developed further conceptually - including but

not exclusively by addition of more carbon pools, differentiation of carbon release timelines, flexibility of demand, and inclusion of new afforestation.

III. Beyond the general sustainability criteria

The current REDII regulations focus mostly on the supply side of biomass and large combustion plants. However, in order for the biomass-to-energy utilisation to be fully sustainable, there need be criteria on the demand side and to cover the household sector. The CEE region has a long history of firewood use in the residential that is predominant to the large combustion plants and the regulations on the residential firewood use are not as strict as they need to be. In this respect, a full package of sustainability criteria for the utilisation of biomass needs to be compiled that ensures its sustainability not only in the sourcing location, but also in the utilisation location. Considering the biomass utilization for energy, we need to focus not only on its sourcing location (as suggested by REDII and LULUCF), but also at its utilization location (large-scale and residential combustion devices). On one side, there is the insurance of the sustainable sourcing of biomass, and on the other, there is the correct approaches to its utilization on site. Considering the biomass utilization for energy, we need to focus not only on its sourcing location (as suggested by REDII and LULUCF), but also at its utilization location (large-scale and residential combustion devices). On one side, there is the insurance of the sustainable sourcing of biomass, and on the other, there is the correct approaches to its utilization on site. The package needs to cover the whole biomass chain – from Harvesting & Legality through Processing to the Market realisation and Biomass combustion. This way, biomass will be sustainably used from both supply and demand perspectives.

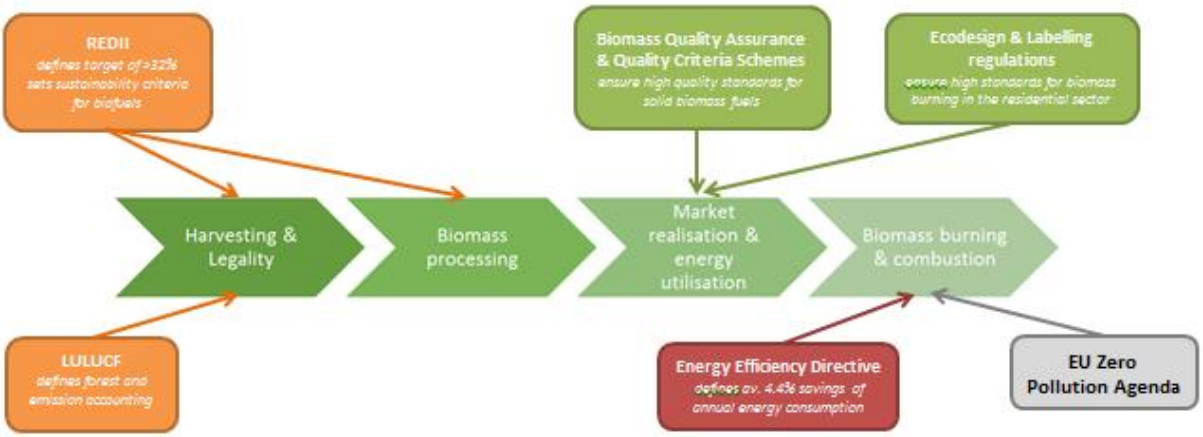

Figure 2 Beyond the REDII sustainability criteria

There are a number of strategic documents that refer to specific requirements on the utilisation of biomass and can be included in such a package:

EU Directive 2018/2001 – The REDII Directive: sets the EU binding targets of at least 32% of EU energy consumption to be renewable by 2030. It provides general guidance on the sustainability criteria for biofuels, esp. lower GHG emissions, and mainstreams the use of renewable energy systems in the heating sector. RED II specifies that advanced biofuels

produced from Annex IX feedstocks should meet a 70% GHG emission saving requirement starting in 2021.

EU Directive 2018/2002 on Energy Efficiency: obliges the Member States to implement measures and actions to save on average 4.4% of their annual energy consumption by 2030. It aims to ensure more efficient use of energy in all sectors, esp. the residential one.

LULUCF Regulation: implements the EU-wide agreement since 2014 that all sectors should contribute to the EU's 2030 emission reduction target, incl. the land use sector. It simplifies and upgrades the accounting methodology under Decision No 529/2013/EU and the Kyoto Protocol, establishes a new EU governance process for monitoring how Member States calculate emissions and removals from actions in their forests, and broadens the scope of accounting to cover all managed land within the EU, using more recent benchmarks for performance – and thereby improving accuracy of the accounts. It has direct implications on the biomass use and utilisation through the **National Forestry Accounting Plans**.

Regulation (EU) 2018/1999 – The new Governance Regulation: obliges Member States to develop integrated **National Energy and Climate Plans** till 2030, outlining how they plan to achieve the EU-wide energy and climate targets. They present the objectives linked to increase in the share of renewable energy in the final energy mix and in particular discuss the role of biomass as RES in achieving these targets.

EU Zero Pollution agenda: a European vision till 2050 for air, water and soil pollution to be reduced to levels no longer considered harmful to health and natural ecosystems that respect the boundaries with which our planet can cope, thereby creating a toxic-free environment. The relevant 2030 targets to biomass burning:

- improving air quality to reduce the number of premature deaths caused by air pollution by 55%;
- reducing by 25% the EU ecosystems where air pollution threatens biodiversity;

Worthy of mentioning are also the **EU Clean Air Policy package** that define the air quality objectives till 2030, **EU Ambient Air Quality Directives (AAQ) (2008/50/EC and 2004/107/EC)** that sets limits to the atmospheric concentrations of a variety of pollutants, and the **National Emission Reduction Commitments (NEC) Directive (EU 2016/2284)** that defines the national emission reduction commitments for five pollutants (SO2, NO, VOCs, ammonia and PM)**.** These strategic documents provide insight into the limits in which the Member States need to "fit" energy consumption, including the consumption of biomass as one of the sources of PM pollution in the residential sector.

Ecodesign and labelling regulations: a set of various regulations that provide information on the minimum Ecodesign and labelling requirements for appliances placed on the EU market. These regulations impact the utilisation of biomass for energy as the quality of the combustion process is defined through the eco-design and labelling.

- **Commission Regulation (EU) 2015/1185 on eco-design requirements for solid fuel local space heaters:** sets minimum Ecodesign requirements for energy efficiency and emissions of new solid fuel Local Space Heaters (LSH). Revision is expected by January 1st, 2024;
- **Commission Delegated Regulation (EU) 2015/1186 on energy labelling of local space heaters:** sets requirements for the energy labelling and the supplementary

product information for domestic solid fuel LSH (excl. electrical appliances), incl. energy efficiency class, label format, product and label information, and technical documentation. The most efficient label (A++) is only applicable to solid fuel LSH on wood pellets.

- **Commission Delegated Regulation (EU) 2015/1187 on energy labelling of solid fuel boilers:** sets requirements for the energy labelling and the supplementary product information for woody biomass boilers, including energy efficiency classes, label format, product and label information, and technical documentation.
- **Commission Regulation (EU) 2015/1189 on eco-design requirements for solid fuel boilers:** sets minimum ecodesign requirements for new solid fuel boilers, incl. energy efficiency, PM emissions, organic gaseous compounds, carbon monoxide and nitrogen oxides.

There is a large number of national strategic documents and supporting regulations that operationalise the high-level targets and monitor their implementation on national, regional and local levels. Their alignment with the European policy framework is essential in terms of its proper realisation; however, the fast speed at which the European strategic framework changes make it impossible for the Member states to adapt their legislation accordingly and enforce specific actions.

IV. Forest Biomass Alternatives in the local sustainable energy planning

The proposals for forest biomass alternatives in the CEE region start from the long-standing tradition for firewood use for residential heating and spans across the “advanced” biomass options and outreaches to the individual and centralised RES-based heating. As many studies have shown, the first wish for an alternative heating of the firewood users would be another type of biomass, so the first proposed alternative is he introduction of a dry wood policy as a transition policy that will ensure the low moisture content of the firewood and thus contribute to its improved calorific and energy characteristics. The second proposed alternative is the “advanced” biomass or biomass-based products for heating that have added market value and have quality assurance mechanisms and criteria already enforced upon them – for example, pellets, chips and/or briquettes. They keep the wood-use tradition intact and propose residential burning practices close to the already known ones by the households. These biofuels are also combusted in modern heating stoves whose energy efficiency levels are ensured through the ecodesign and labelling regulations. The third proposed alternative is the switch from firewood to another fuel source that is also RES-based so that the pollution limit values are kept as low as possible. This alternative proposes individual replacement of the old residential stoves with RES-based heating (Pve, PVth, solar thermal, geothermal, etc.). And the last proposed alternative is the community-based heating options utilising renewable energy source. This alternative requires broader, long-term sustainable energy planning of the entire community and involves significant investmetns.

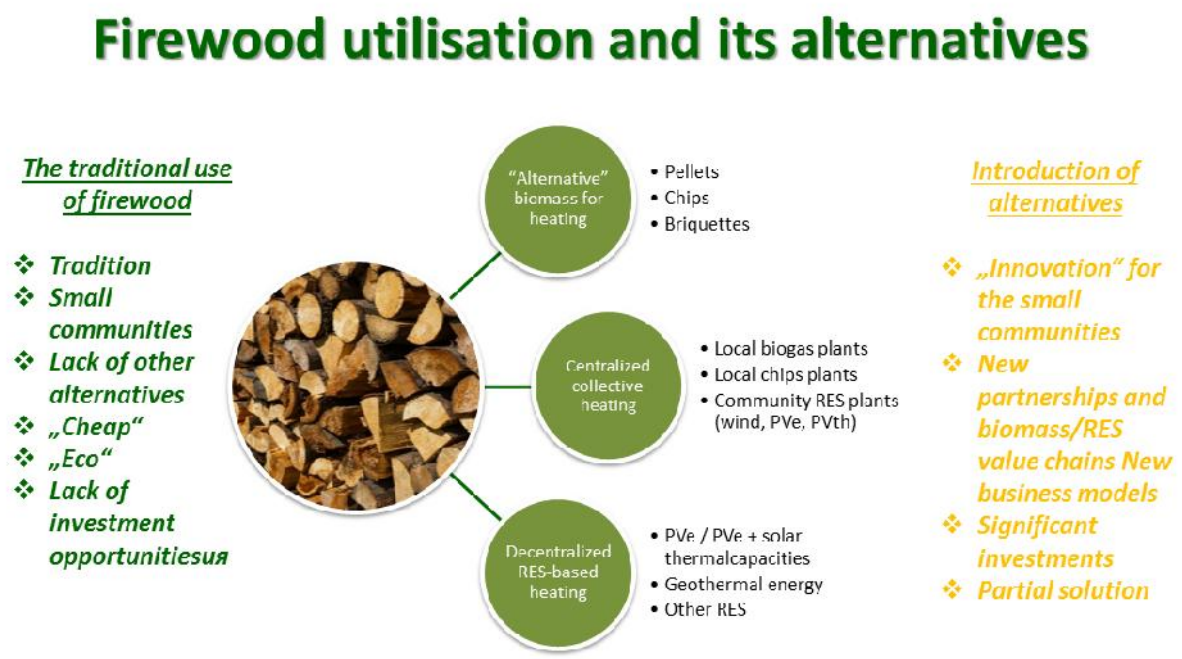

Figure 3 Firewood utilization and its alternatives

Dry Wood policy

The Dry Wood policy is the first proposed alternative. It preserves the firewood use; however, it requires the enforcement of regulations related to the quality of the firewood and distributed on the market – it should be with less than 30% moisture content compared to the traditional 55-60% moisture content. The enforcement of the Dry Wood policy may contribute to 75% reduction in the wood dependency and the corresponding emissions and thus becomes a suitable “smooth” transition policy that provides time for alter alternative options to take place and the market makeover to happen.

The dry wood alternative is based on local organisational policy concerning the biomass market – the wood harvested and cut into firewood, then sold on the market, needs to be stored in a dry place for at least one or two seasons. In this regard, the local authorities may provide a dry storage for the leftovers of the firewood for all sellers and retailers in exchange for their cooperation to sell first this dried wood in the next season. The local authorities can enforce the policy by restricting the local firewood providers from selling wood under a specific moisture value and providing a drying place for the firewood; on the other hand, the local authorities may oblige the citizens to use dry wood and arrange regular checks of the firewood stored in the households. A campaign among the population may be conducted to teach the benefits of burning dry wood instead of fresh one; in practice, the households burn first “old” wood that has stayed for a few seasons first, so this campaign should only strengthen their current practices. The use of dry wood will provide better thermal comfort and may reduce the energy bill significantly. It will have major impact in terms of the air pollution.

Unfortunately, the enforcement of the dry wood policy will take at least two seasons to perfect. Also, the local firewood providers may be reluctant to slow down their businesses in order to provide drying time for the wood used or the citizens may be reluctant to store the firewood that long. So, the cooperation of the local wood sellers and retailers is essential as well, because without their cooperation, the local authorities will have to forcefully impose this policy which may not prove successful at the end.

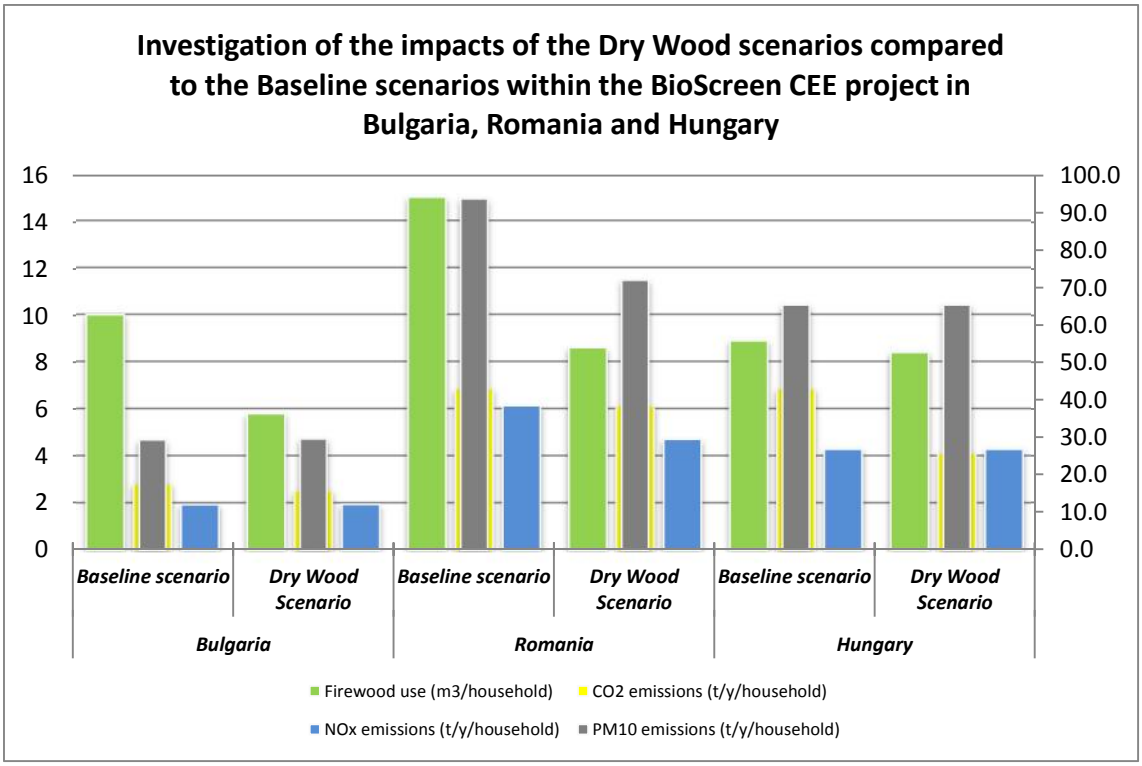

Figure 4 Investigation of the impacts of the Dry Wood scenarios compared to the Baseline scenarios within the BioScreen CEE project in Bulgaria, Romania and Hungary

Table 1 SWOT for Dry Wood Policy alternative

Alternative Scenario	Strengths	Weaknesses	Opportunities	Threats
Dry Wood Policy	Lack of high investment costs Improvement of the energy comfort Reduction of the demand for firewood Reduced energy bill due to the reduced wood	Full implementation of the policy will not be enforced immediately Effects from the policy enforcement will be visible 1-2 years ahead Does not imply highly improved CO2 emissions'	Investment-free policy that has strong and quick positive impact Non-disruptive 'transition' policy, i.e. does not require for the households to change quickly Cooperation	Objection from the wood providers to retain the wood to dry for 1-2 seasons Demand for "drying" place for the firewood Attempts to "cheat" with the moisture content to sell firewood in the

	demand	impact Medium air pollution impact	opportunities with the local stakeholders	same season

"Advanced" biomass alternatives

The "advanced" biomass is the second proposed alternative option to firewood use. As it is widely acknowledged, households that are used to using firewood for heating would like to stick to the biomass use for a number of reasons – the heating practices are similar so there won't be disruption in their routine, they already have established traditions for using wood, they like the warmth and cosiness of the fire, they prefer to make small investments, etc. This alternative preserves the use of biomass for heating but under another form – as "advanced" biomass products such as pellets, chips, and/or briquettes. These products have added market value and are usually under high quality assurance standards and requirements.

This alternative proposes a complete makeover of the local biomass market that is dominated by the firewood use. The advanced biomass products prove to be a better biomass-based option because of their extremely low moisture values (usually 10%) that provides more thermal energy and lower emissions. The implementation of this alternative is a subject of market transformation rather than local policy enforcement like in the Dry Wood alternative and so it will take more time for the shift to make change. The makeover of the market may be a turbulent action, because the local providers will need to restructure their production and distribution chains; new actors may come on the market. In the first place, the local wood providers need to consider the added value of producing and/or importing pellets rather than firewood. They would need to invest into new equipment and re-organise their business; on the other hand, the households would need to change their old stoves with new ones and get used to the new heating fuel. In addition, the households will need to replace their old heating equipment with new stoves or boilers which will require investment on their side. The local authorities may support the change by providing incentives to the households to make the switch or enforce quality and certification standards for the users. They may enforce policies to support the market actors and the households to speed-up the transition, but even in this case, it will not be sufficient to switch all households to pellets or other products.

The new heating equipment will provide improved thermal comfort and health safety for the community. The roll out of the advanced biomass market will improve the market conditions and introduce new market players that will make for a competitive low-carbon heating market. It will also provide clean heat for the households – the environmental impacts will be lower compared to the baseline due to the improved calorific value of the advanced biomass products. These products have near-zero CO2 emissions due to the carbon neutrality of the sustainable biomass fuels according to the IPCC emission guideline and the high efficiency of the new devices. The air pollutants will be significantly reduced, because of the efficiency of the new stoves and boilers that achieve complete combustion and do not emit particulate matter. Currently, the market price for the advanced biomass products suggests that the individual investment in them and their heating equipment will have a slow return rate.

Another obstacle may be the reluctance of the local firewood providers to change their business or allow new market actors.

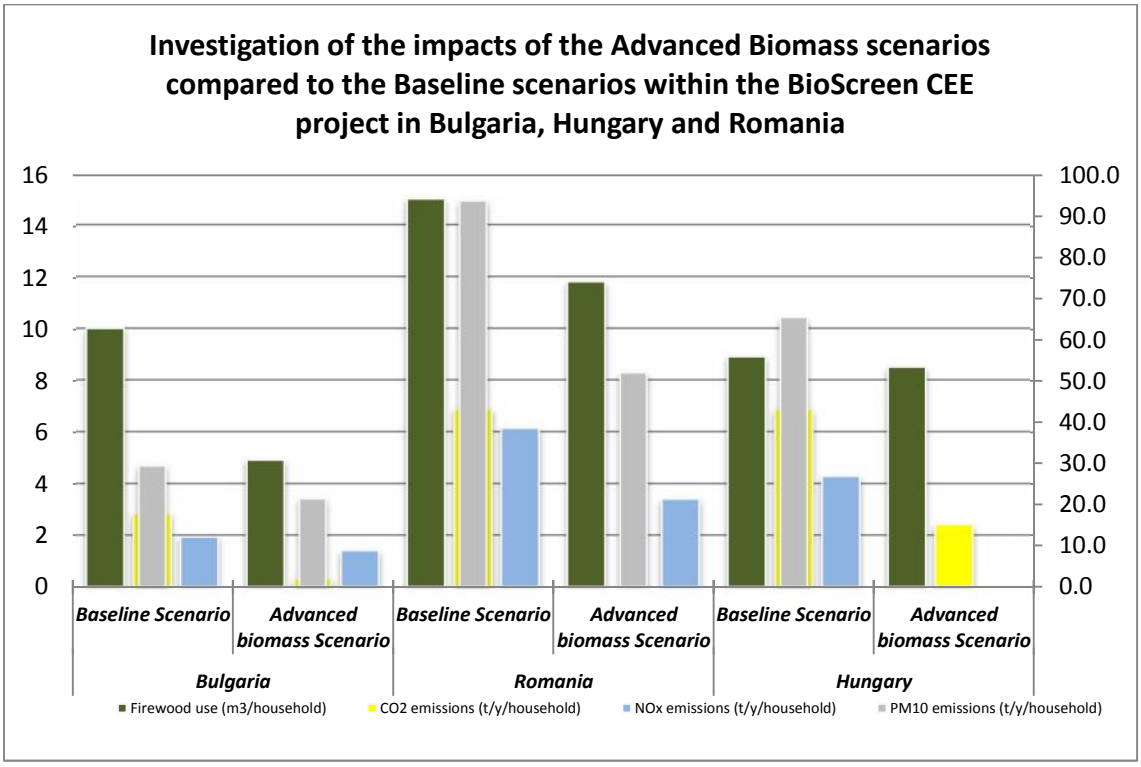

Figure 5 Investigation of the impacts of the Advanced biomass scenarios compared to the Baseline scenarios within the BioScreen CEE project in Bulgaria and Romania

Table 2 SWOT for Advanced Biomass alternative

Alternative Scenario	Strengths	Weaknesses	Opportunities	Threats
Pellet Stove Scenario	Improvement of the energy comfort and health benefits Reduction of the demand for firewood Improvement of the energy comfort and health benefits Major air pollution impacts Pushes “green” evolution of the biomass market	Minor investment costs for new pellets stoves/boilers Slow transition for all households Market not ready to provide the full volume of pellets Potential slight increase of the energy bill Wood demand decreased, but still in demand	Expand the market for advanced biomass products Stronger uptake of the pellets as sustainable alternative to the firewood Local provision of biomass products with added values Improved management of the forest resources	Slow transition to sustainable biomass Pellet producers not present on the market; difficult to “break through” the firewood dependency

Decentralised Individual RES-based heating

The third alternative discusses the potential for a push on the market for RES-based heating technologies in combination with conventional energy sources. This alternative represents a mix of alternative energies deployed individually by the households which are RES-based in the best case scenario. The alternative heating options may vary greatly – from PVe and PVth through solar thermal and geothermal energy as standalone installations or in combination with conventional energy sources as back-up options. All of these options provide reliable and clean energy for the households and good thermal comfort at very low environmental impact.

The alternative energy mix option suggests investments in new equipment which may be considered feasible on household level; however, the investment realisation may take time and slow down the overall policy implementation. Another obstacle is increasing prices of energy which will make the alternatives less financially viable compared to the traditional wood use and thus the individual investment in them will have a slow return rate.

In most of the investigated cases, the households would opt for a PV-based energy supply for both heating and domestic use. The positive attitude of the end users towards PV deployment has been identified through different surveys across the participating countries - overall, the electrification of the residential heating sector may seem inevitable in the situation of rising natural gas prices and the needed wood and coal phase out; however, if electricity is derived from the grid, its environmental impacts may not be so beneficial in the long-term. The positive aspect of the PV deployment is that it can supply electricity for heating in the winter season and supply electricity for domestic use in the summer. The PV 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 significant amount of time and efforts and their procurement will be too slow to cut the dependency on wood as per the European ambitious objectives. That's why the deployment of PVs may be a potential solution.

One obstacle to their deployment may be the insufficient rooftop space that will not allow for the final users to produce enough electricity to cover their demands; battery storage solution may alleviate this. Another positive aspect of PV deployment is the potential for prosuming which is not fully unlocked in the energy market is the building-to-building electricity trade or vehicle-to-building balancing.

Other non-biomass RES solutions could be the solar thermal installations that are easy to couple with the PVs, but could be used only for heating or domestic hot water. Another option could be the geothermal heating which may be costly option for the wood-dependent households and the geothermal potential of the site may be insufficient.

The RES-based alternatives provide significant energy independence and have potential to unlock new niches on the energy markets in terms of energy trade, self-consumption and prosuming, demand response and flexible tariffs. They will provide decarbonised diversification of the energy supply; however, the transition may be slow if no subsidies are in place. Most of the proposed RES-based alternatives are not possible to implement in wood-dependent households unless there is an external financing scheme for them. The market for

RES solutions will grow stronger and more competitive over time and customised solutions for each home may become available and financially viable for the end users.

The alternative to firewood use based on the own wishes for diversified energy supply from the households is a self-driven process in which the households make individual decision on the best option for them rather than agreeing to a general energy strategy developed by the authorities. It is non-disruption "transition" policy as it does not require the households to change quickly and to follow a city-wide strategy for energy diversification. This alternative is acts strong upon the user demands, but may not be reasonable in terms of the sustainable energy planning on urban level.

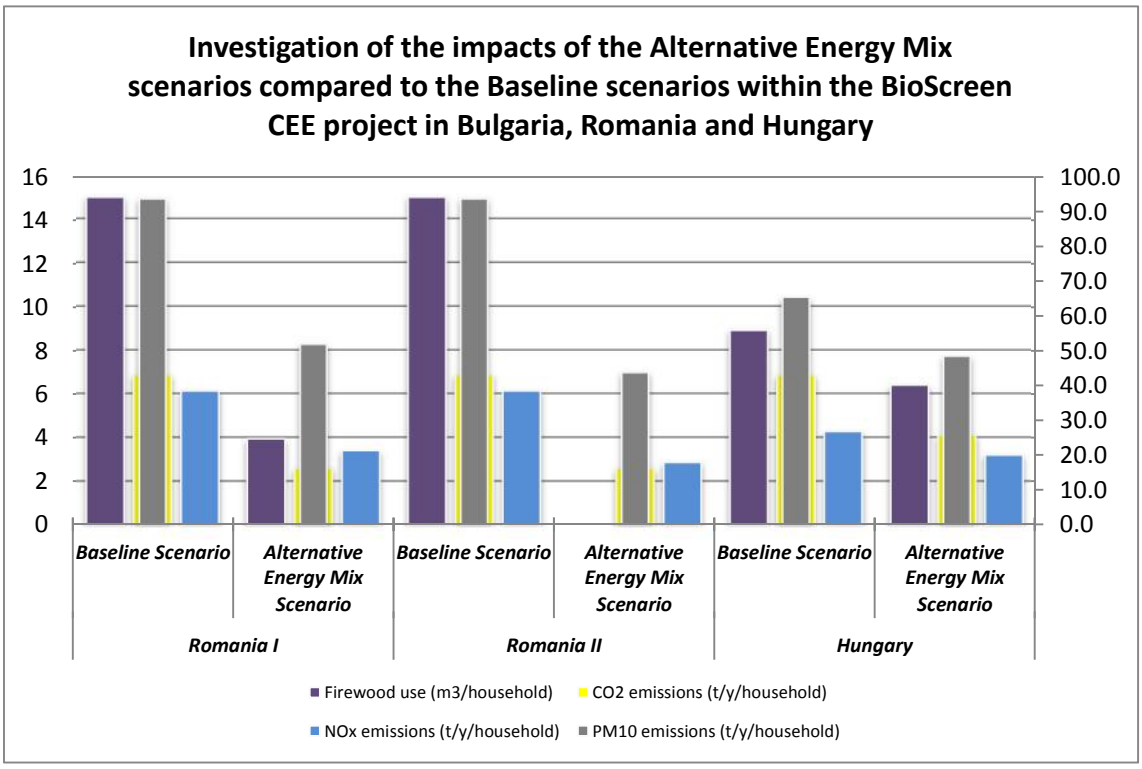

Figure 6 Investigation of the impacts of the Alternative Energy Mix scenarios compared to the Baseline scenarios within the BioScreen CEE project in Bulgaria, Romania and Hungary

Table 3 SWOT for Alternative Energy Mix alternative

Alternative Scenario	Strengths	Weaknesses	Opportunities	Threats

Alternative Energy Mix	Provides reliable and clean energy for the households and good thermal comfort Clean energy from PVs Significant energy independence PVe supply for domestic hot water and other domestic purposes in the summer Reduction of the demand for firewood Mitigate most of the CO2, PM and NOx emissions	Significant investment needed for its establishment (incl. building urban infrastructure) Diversification of the energy use will happen slowly, esp. if no subsidies are provided Significant investment for heating devices and their supporting infrastructure per household PVe produced energy may not be sufficient; grid electricity may be needed Market competition may grow stronger No tailored technical solution for each home	Uptake of the energy independence and self-consuming and prosuming Potential market expansion of the RES technologies and services Active role of the consumers on the energy market Scenario represents the energy diversification as the citizens would like it to happen Non-disruptive 'transition' policy, i.e. does not require for the households to change quickly	Investments not paying back as quickly as needed The rising prices for natural gas and its market deficiency Market competition and opposition from the local producers and providers Rising PV technology prices, high prices for the battery storage Increasing electricity prices in cases of feed-in Electricity use may have adverse effect on the energy balance Diversification will happen slowly

Centralised Community/Collective Heating

The fourth alternative option introduces the concept for **Centralised Collective/Community District Heating** based on agricultural biomass and biomass residues; it may also be considered as another RES-based scenario in which a community energy cooperative for RES production to supply heat is deployed. The alternative suggests that a power plant for the entire community is built and the majority of households switch to using heat from it. Thus, it will provide thermal comfort and low-emission heating for the entire community. It offers significant benefits for the households in terms of energy comfort and supplementary energy services.

The community heating will settle new agricultural biomass/biomass residue utilisation chain that will need to have the local biomass stakeholders provide resources for the plant; in addition, there will need to be investment for the plant and the local network that may be significant and slow to acquire through public or other funds. It requires high investments and its implementation period may be extremely long. Considering the financial impacts per household, it seems that the investment as split per household and its implications on the energy bills in comparison with other options may make it a desired option among the households (if all of them join the centralised heating network).

This option is a risky one to implement due to the uncertainty of the user perceptions and wish to switch and may not be feasible in the short term, but will provide very good opportunities for local development in the long-term.

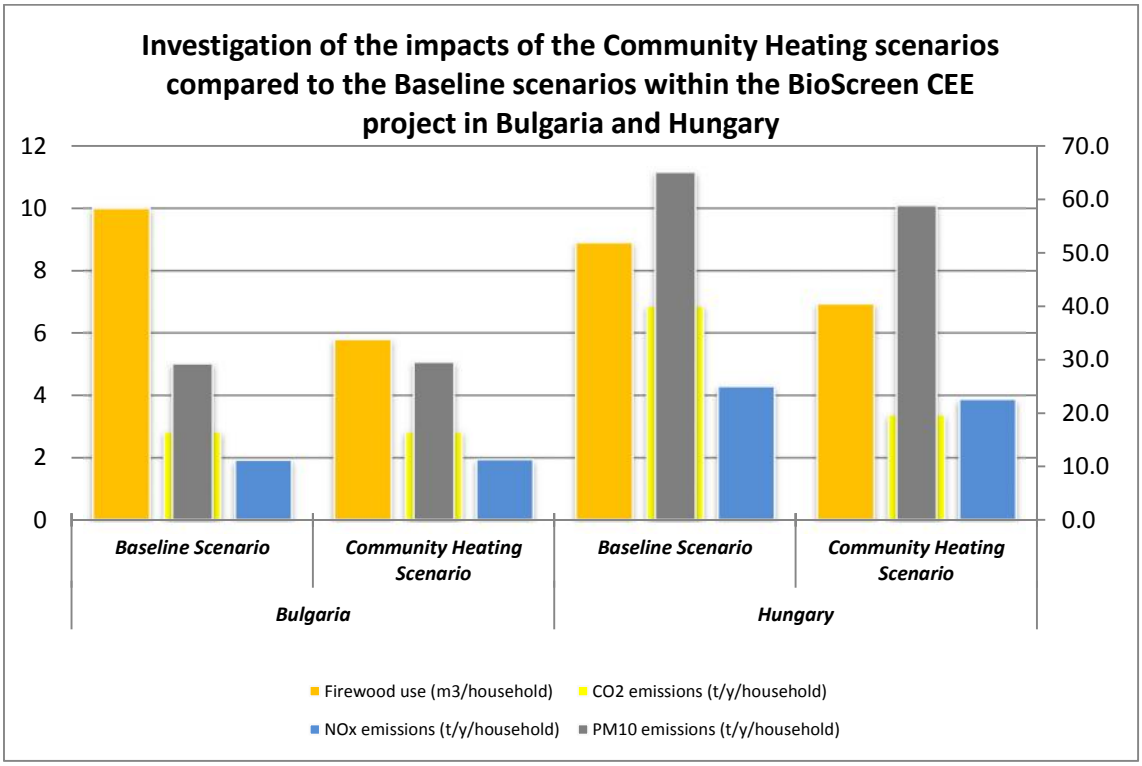

Figure 7 Investigation of the impacts of the Community Heating scenarios compared to the Baseline scenarios within the BioScreen CEE project in Bulgaria and Hungary

Table 4 SWOT for Community Heating scenarios

Alternative Scenario	Strengths	Weaknesses	Opportunities	Threats
Community Heating	Heat and DHW supply to the entire community Provides low-emission heating for all households Significant energy independence Does not have major environmental impact	Major investments per household needed Still use of wood resources will be needed Construction of infrastructure will be needed to distribute the heat Stakeholder cooperation needed; organisation of the	Community heat generation based on RES will provide decentralisation and independency Full utilisation of local resources Increased market value of the biomass and agricultural local resources Full decarbonisation of	Unwillingness of the local stakeholders to cooperate High investment prices Unwillingness of the local users to switch to the community heating; this will affect the investment reimbursement Investment may

		new resources needed	the local community Development of new partnerships with investors and energy providers	not be reimbursed due to changing energy prices

V. Supplementary measures and actions to support the sustainable biomass utilisation

As already pointed out, ensuring the sustainability of biomass-for-energy needs to start from the sourcing location, but also needs to be extended to the utilisation location and proposal for this have been made. However, there are a number of supplementary measures and actions that can be implemented from the local or national authorities to strengthen the enforcement of the sustainability criteria:

Policy enhancement recommendations

1. Synchronizing the biomass definition and data sets across the local and national bodies responsible for forestry and energy;
2. Establish clear biomass-to-energy inventories, databases and methodologies for the national and local strategic documents;
3. Stepwise transposition of the REDII and other European best practices into the national legislation, produce sub-national regulations and links to other regulations to ensure sustainability;
4. Non-forestry biomass should also be considered in the sustainability requirements;
5. Set up an expert group where all the agencies responsible for producing statistics and authorities with additional data sources are represented and academic and civil society organisations are given the opportunity to learn about and comment on the methodology;

Biomass alternatives planning

6. Develop in-depth analysis of the biomass-for-energy usage from demand side perspective;
7. Conduct regular studies and collect precise data on firewood and other biomass products used from the population;
8. Develop intervention logic for replacing firewood usage with specific energy alternatives when doing local sustainable planning within strategic documents (i.e. SECAP);
9. Develop specific pipelines for firewood phase-out in local communities;
10. When alternatives are not possible, new standards and requirements needs to be in place;

Emission and efficiency enhancement policies

11. Establish national guidelines on fuel quality standards for providers and end users;
12. Enforcement of stronger emission and efficiency standards for stoves and boilers sold on the local markets in highly polluted areas;
13. Enforcement of stronger standards for solid fuels used in residential burning similar to the ENplus or Blue Angel certifications;
14. Propose only BAT solution when conducting woodstove change out programmes;
15. Establishing “chimney sweep” mechanisms and/or campaigns to ensure proper use of the combustion devices;
16. Establishing pollution monitoring stations to better manage emission values;
17. Establishing low-emission zones in densely populated urban areas;

User-centred firewood interventions

18. Enforcement of legislation and promoting sufficient competences/measures to address illegal burning;
19. Enforcement of registration, monitoring and maintenance of residential burning appliances;
20. Establish integrated renovation actions that encompass high energy efficiency measures and heating refurbishment;
21. Set-up user raising awareness campaigns for efficient combustion, i.e. “Burn Right” campaigns;

Recommendations on financial tools and mechanisms to ensure biomass sustainability

22. Restrict the public incentives for fuel support for firewood and coal use;
23. Provide a list of incentivizing financial tools to support transition to low emission appliances.