Energy and heat generation from wood-based biomass - a sustainable alternative for coal-fired power plants and forest ownership?

By **Thomas Meth,** Executive Vice President, Sales and Marketing, ENVIVA & **Silvio Mergner**, Head of Business Development, BaySF (Bavaria State Forests)

You both represent two very different industries. What motivated you to write a joint contribution on this topic?

Silvio Mergner: That is correct, we represent two companies that are fundamentally different in nature and geographical focus: Enviva as the world's leading wood pellet producer with a great growth story, the Bayerische Staatsforsten (BaySF) as a public entity responsible for the sustainable management of the Bavarian state forest, covering approx. 720,000 hectares of forest.

Our main purpose is the preservation of healthy forests, the supply of wood as a raw material for construction, packaging and hygiene, and protecting nature and the species that live in forest ecosystems. Not to mention the many thousands of employees, suppliers, and customers with whom we work every day.

Thomas Meth: The aspect of sustainable forestry is fundamental for the future of both of our organisations. Increasing damage caused by drought, storms and pests presents a major challenge for forest owners. The current situation with regards to damaged timber in German forests illustrates the importance of managing and caring for forests sustainably. Both organisations have a common interest in preserving forests and ensuring the conversion to climate-proof forests of the future, also in economic terms. At the same time, we must create markets that take care of this goal.

Germany faces the enormous challenge of rapidly expanding renewable energies and implementing the coal phase-out quickly and efficiently.

Thomas Meth: Hard coal and lignite now account for about one third of electricity generation in Germany. The phase-out therefore requires the replacement of about 200 TWh of electricity through a variety of measures. Higher targets for the use of renewable energies should lead to greater investment in wind, solar and biomass, combined with an increase in gas-fired generation capacity. This poses the following challenge: in the absence of alternative storage capacities, natural gas and biomass (and, regionally, geothermal energy) are so far the only energy sources that can provide large quantities of electricity and heat on demand at any time, such as for district heating in the winter months. In view of rising climate targets, sustainable wood energy can and should provide a growing share here.

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Silvio Mergner: We totally agree. Forest ownership in Germany faces major challenges. Wood that is damaged through bark beetle or storms can obviously be used to produce industrial wood pellets. Coal that is used as fuel in existing power plants can be partially replaced, contributing to a rapid and inexpensive decarbonisation of electricity and heat. This principle has been tested in other European countries such as the UK, Denmark, and Sweden. If it is done right, it can be a win-win situation for both sides: the parts of the damaged wood that cannot be used for other purposes are reused economically, which benefits forest conversion; power plants can be offered an alternative way of generating renewable energy without the need for new infrastructure.

Thomas Meth: Domestic and international markets complement each other in this regard and

together contribute to additional value creation. In Bavaria, the expansion of municipal biomass power plants operated with wood chips has been underway for some time now. BaySF is leading the way here and is an important supplier.

The fact that wood residues are also suitable for use in former coal-fired power stations via the intermediary step of pelletization extends the range of possible applications for wood energy, especially since such pellets can be produced from a wide range of damaged and residual wood, including hardwood. This flexibility is very beneficial to forest farmers in terms of forest conversion.

The decision to phase out coal will have to result in significant changes in energy production in Germany, what are the consequences in your view?

Thomas Meth: First and foremost, the challenge is to generate electricity and heat from renewable green energy sources without creating supply and capacity gaps. In the case of electricity supply, this can be achieved by using wind power and photovoltaics. It is more difficult in heat generation, where these weather-dependent technologies cannot replace coal and a much smaller range of alternatives is available. But wind and solar power also need renewable "gap-fillers" in times of little wind and sunlight, and to ensure 24-hour supplies of green electricity.

Silvio Mergner: According to experts, not all coal power plants in Germany can be converted to gas, leaving operators with few solutions for the continued use of sites. Wood pellets can complement the renewable energy mix and represent an additional component in successfully implementing not only the transition of electricity, but also the heat transition. That is why we believe that conversion of power stations to wood as primary fuel, especially in combined heat and power (CHP) plants, should at least be considered. Conversion of plants has the advantage that a lot of the existing infrastructure can still be utilized, which saves costs. This saves jobs and can even create new ones.

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Is it possible to burn wood in coal-fired power stations?

Thomas Meth: One can, and in view of the climate targets, one should do so where appropriate. We have already collected many years of experience in this regard. A conversion of power plants to wood pellets that meet EU sustainability criteria (RED 2), is technically not too demanding and – as we have seen in Denmark, for example – technically possible within about two years. And this at a fraction of the cost of a new power plant. The possibility of replacing coal with wood energy could be relevant in Germany, especially for system-critical plants. In power plants with combined heat and power generation it is even possible to achieve a climate-friendly efficiency factor of up to 90%.

Silvio Mergner: If the funding conditions in Germany are right, then the entire timber supply chain will benefit, and the forest will also benefit. When it comes to wood pellets, climate policy and economic policy meet in equal measure.

Denmark is often considered as a good example of fast and successful decarbonisation of the electricity and heat grid. The country has reduced its coal consumption by more than 70% between 1990 and 2018, while its renewable energy share has increased by almost 440%. For example, the former Avedore coal-fired power station in Copenhagen now supplies more than 200,000 households with district heating and electricity generated from wood energy. Further biomass power plants are planned, so that each of the city's 600,000 inhabitants will soon be supplied with electricity and heat without the use of fossil fuels. In this context, damaged and residual wood that can be used for energy purposes makes an important contribution to the substitution of fossil fuels in the form of wood chips or wood pellets.

What proportion of the wood harvested is already being used for energy? How do you estimate the potential in the future, especially regarding the development of demand from the paper industry?

Silvio Mergner: For larger forest owners in Germany, the share of wood used for energy purposes is generally 20% of the annual sales volume. This includes material from treetops for example, which must be chopped to prevent bark beetle from becoming an even greater risk factor. This removes the beetle's breeding ground, which is an essential factor for successful management. Forest owners need to be quick here, but they also need to be able to afford it. At current log prices in the market, this practice is often no longer economically viable for forest owners, in practice this basically means that some forest owners have given up.

Of course, sustainable domestic wood supply has its limits. After all, it is no question that we will maintain healthy forests that grow in the long term, bind a lot of CO_2, and provide society with the many and varied services of sustainably managed forest ecosystems.

For energy use, inferior parts of a tree that cannot be sawed are used, such as branches, treetops and damaged wood that cannot find a higher quality outlet. As the material use of wood grows, for example in construction or in sustainable insulation materials, the proportion of waste materials produced also grows. When you harvest trees, you always have by-products.

Thomas Meth: We have also had this experience in the densely wooded southeast of the USA. A marked decline in the paper industry in the USA has led to a surplus of wood formerly used for paper, which is equivalent to more than 35 million tonnes of pellets per year. Of this amount, about 6 million tonnes are currently being used for pellet processing. Enviva regularly receives enquiries from regions looking for new customers for this variety of wood.

The structural change of the local paper industry in the south-eastern USA has contributed to the development of today's pellet industry. Since there was suddenly no market for these inferior woods, the pellet industry there was able to fill the gap.

Silvio Mergner: In Germany, the pulp industry is not as big, and the situation here is not comparable with the US. However, industry structure is changing as well. Pellets will ultimately only be produced from low grade material; other markets usually have a higher paying capability.

The current bark beetle plague in Germany appears unique, as does the proportion of damaged wood. Will there be enough fuel in the future?

Silvio Mergner: That's an important question. Around one third of the German landscape is covered with forests. With more than 3.4 billion cubic metres of wood growing stock, which means trees, Germany's forests store more carbon than any other country in the European Union.

Sustainable management is deeply rooted in the sector. 70% of forests in the country are certified by key standards of sustainable forest management in the region, PEFC or FSC. A high number, given that the forest is spread over more than 2 million owners, mainly private individuals.

Forest owners in Central Europe have indeed encountered big problems during the last 3 years: hot and dry summers and storm events led to a massive increase in trees killed by bark beetle. As a result, salvage logging increased, to control the damage and retain forest ecosystems, carbon storage and value. Harvesting levels in Central Europe skyrocketed by 50% with the effect that prices dropped to rock bottom levels that are not sustainable for the sector. Luckily, the wood processing industry in the region is highly innovative and strong. Plummeting market prices for logs and wood chips raised the industry's competitiveness and triggered necessary investments.

In the years 2018, 2019 and 2020, approx. 178 million m^3 of damaged wood* has accumulated in Germany. I think we have reached the peak this year, but it is clear to everyone that we will have to prepare for more damaged wood for some time to come. It is not only in Germany that we have seen how climate change is causing major problems for forest ecosystems.

German forest owners are fully aware of the need to change the structure of their forests to increase resilience against climate change. These efforts are a combination of harvesting of mature but instable stands with

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*Source: BMEL.de (German Federal Ministry of Food and Agriculture)

low resistance levels during dry summers, and regeneration both naturally and through planting. Moreover, more importantly, these efforts require sufficient funding: log prices are no longer sufficient as a revenue form in this respect. The result? Those forest owners that have not been as affected by weather extremes and insects avoid harvesting, since it is unprofitable. This decision to postpone harvesting or thinning of forest stands increases stand risks for future years in many cases. Stands, often monocultures of spruce, become more susceptible for future damage. At the same time, preparatory regeneration is postponed due to financing issues and in the case of damage, no young trees are there to take over.

Thomas Meth: Decision makers face a lot of difficult questions: How much wood will there be from local sources, which price levels are required for the various actors in the value chain in order to sustain the partnership and market dynamics? And is this all sustainable? There is a clear "chicken and egg" problem. With no investment case, utilities are hesitant to enter the public debate. With no offtake visible in such a new field and facing massive challenges in core areas of their business, no strong forest owner like the company Silvio is representing is in the position to undertake big efforts to pave the way for something new.

Political decision makers have only limited time to set out the optimal pathways ahead that work for both the market and society. To solve these challenges best, innovative, and agile forms of collaboration between participants along the value chain are required. We are engaging actively with companies along the whole value chain to contribute our share.

Power plants need long-term security of fuel supply. In the timber market, long-term contracts are rather the exception. How can power stations ensure that they always have an adequate supply of fuel?
Silvio Mergner: That is not fully correct. Smaller suppliers cannot or do not want to enter long-term supply contracts, that is the nature of things. But larger forest owners for sure do. Long-term contracts also play an important role for us in Bavaria. In the end, forest owners and wood buyers are partners.

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Thomas Meth: Power plant operators must be able to rely on the fuel being available permanently and safely. Regarding the security of supply of industrial wood pellets, local and international markets complement each other ideally. For energy suppliers, it makes sense to explore local production and supply chains first. This provides German forest owners with an additional source of income from supposedly worthless damaged wood which cannot be used for any other purpose but is suitable to produce industrial wood pellets.

The international market can provide relief in the event of bottlenecks and replenish residual volumes, thus providing energy companies with the necessary security of supply. Supply contracts in the international market are usually designed for ten to 20 years, thus offering planning security. International certification systems ensure sustainability. Pellet imports from the USA for example, therefore, represent a safe reserve for an energy supplier's plans to switch from coal to wood energy.

There is a view that untouched natural forest is more resilient to climate change than commercial forest. On the other hand, "protect through use" is an oft-used phrase. In Bavaria there are both national parks and commercial forests - how do you assess the situation?
Silvio Mergner: We believe it is important to find the right balance. Forestry in Germany pursues a holistic approach. Forests fulfil a wide variety of functions. On the one hand, the ecosystem must be protected, and we need to secure air, water, and soil quality. On the other hand, it is a social objective to also manage forests to provide a renewable and ecologically valuable raw material which contributes to decarbonisation. As a country, we also do not want to become dependent on wood imports, that is no option either I believe. The term "commercial forest" must not be confused with monoculture. In Bavaria, we have mainly mixed forests which are managed without clear-cuts. We have been working intensively on the conversion of the remaining pure stands for more than 30 years now. We have plans in place to convert the last remaining spruce monocultures in those places where they do not fit the climate by 2030. These are major efforts. Recently, together with our owner, the Bavarian state, we decided to step up our efforts against climate change: by 2024, we will plant a total of 30 million trees to make our forests even more robust in the face of climate change and to make the conversion to climate-proof forests of the future.

Sustainable management of these forests is necessary to ensure their health. It is important that protected forests, such as national parks, are not played off against commercial forests. The truth is, we have a mix of protected area categories. More than 10% of our forests are permanently unused. Another 20% are classified according to various protection categories. It is essential that we find a good balance so that we can achieve climate protection, species and nature conservation with the requirements of the society in the best possible way.

Thomas Meth: It is of great importance to us at Enviva that we have a close and trustworthy relationship with all our partners. We are always impressed by how different the natural areas are worldwide. Forest ownership ensures that the raw material wood is available sustainably and is used in the best possible way. We have known the global and regional market dynamics for wood pellets for many years and therefore see ourselves as a link to power plant operators. Many of the questions currently being asked by political decision-makers about the coal phase-out in Germany can only be answered together.