How restrictions on “primary woody biomass” will impact Swedish energy and climate development

Analysis by Svebio – Swedish Bioenergy Association

The European Parliament has proposed restrictions on the use of "primary woody biomass" in the Renewable Energy Directive (RED III). No impact assessment has been made. This report summarizes impacts of such restrictions on the Swedish energy use and on Swedish climate policies and targets.

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Summary

The proposed restrictions by EU parliament on primary woody biomass (PWB) will impact the energy use, GHG emissions, and future bioenergy development in Sweden in a number of ways:

- About one third of the biomass used in Swedish district heating and biopower production is derived from forest residues and discarded wood. If these fuels may not be used, they will have to be substituted with other fuels, most likely fossil fuels, resulting in increased CO_2 emissions. This will also lead to higher costs for consumers.

- The reduced use of forest biomass will also reduce the potential for negative emissions through bio-CCS. Sweden has a potential to capture 30 million tons of biogenic CO_2. A reduction by one third would mean 10 million tons less negative emissions potential.

- The future development of the Swedish bioeconomy would be strongly hampered if forest residues may not be used, or if the use will be capped, as the major part of the potential for increased biomass use would be from harvesting residues. This would affect increased production of biopower, e.g. for flexibility in a renewable fossil-free power production system, local production capacity, balancing and other system services.

- It would also strongly limit the development of advanced biofuels production and production of electrofuels, needing green carbon molecules. Further, development of biocarbon production for industrial applications would be impeded.

- In Swedish managed forestry 148 TWh of harvesting residues are left in the forest every year. Only 10 TWh of slash is collected and used for energy. An increased harvest of 60 TWh of residues is possible complying with EU sustainability criteria.

- Leaving more biomass residues to decompose in the forests at harvesting sites will lead to increased release of CO_2, on top of increased emissions caused by reduced substitution of fossil fuels.

- Thus, if PWB fuels could not be used, the negative climate impact would increase in three different ways: increased CO_2 emissions from decomposition in the forests, increased CO_2 emissions from decreased substitution, and reduced potential for negative emissions through bio-CCS. These effects will reduce Sweden's ability to reach already adopted climate targets for 2030 and 2045.

- It will also impact Europe's possibilities to reach adopted climate and renewable energy targets by reduced export of renewable energy from Sweden to Europe and reduced possibilities to acquire negative emissions from bio-CCS.

Effects on the fulfilment of climate and renewable energy targets in Sweden

Targets for Sweden are defined in the Swedish climate law, adopted by parliament in 2017 and in effect since 2018. The purpose of the law is to contribute to the Paris agreement's target of limiting global temperature increase to 2°C above pre-industrial levels, and strive for limiting the increase to 1.5°C.

- The Swedish climate law includes a national target for net-zero emissions in 2045. Territorial greenhouse gas emissions must be reduced by 85% to that year, and supplementary measures like bio-CCS and other negative emissions may be used for the remainder.

- The parliament also decided on sub-targets for 2030 and 2040. The GHG emissions in the ESR sector (excluding ETS) will have to be reduced by 63% by 2030 compared to 1990, and by 75% in 2040 compared to 1990. The territorial emissions in 2020 were 35% lower than in 1990, including Swedish ETS emissions.

- A sub-target has also been formulated for the domestic transport sector. This target is to reduce emissions by 70% in 2030 compared to 2010.

- In the Fit for 55 package, the EU Commission has proposed a target for Sweden of reducing GHG emissions in ESR by 50% by 2030 compared to 2005, an increased target from 40% in the current regulation. Sweden also has to contribute to the renewable energy target, which is supposed to increase from 40 to 45% in EU according to REPowerEU. Sweden already has the highest renewable share in EU, 61% in 2020, and did overshoot its 2020 target, which was 49% in RED I. This was not least a result of increased use of bioenergy.

It is safe to say that these targets are very ambitious considering that Sweden already today has the lowest GHG emissions per capita in all of EU.

In what way will a ban on primary woody biomass threaten these targets?

Bioenergy today makes up 38% of the final energy use in the Swedish economy, and is the largest energy source. The bioenergy use is highest in the heating sector, mainly as fuel in district heating, and in the industrial sector, particularly in the forest industry. But in recent years, the biggest growth has been in transport, mainly through increased use of biodiesel (HVO). It is also in the transport sector that further deployment of bioenergy has the biggest potential. But there is considerable potential for bioenergy growth also in industry and biopower production.

Roadmaps from Fossil Free Sweden, a project within the Swedish government, show an increase in demand for bioenergy from major industrial sectors and transport of 75 TWh until 2045. This can be compared to the current use of bioenergy of around 150 TWh, of which a little more than 100 TWh is sourced from domestic forest biomass. Of the increase, 23 TWh is expected in industry and 52 TWh is expected in transport, including work machinery, e.g. in agriculture. Much of the demand will be for liquid and gaseous biofuels. Some of these can be

produced from forest biomass in new biorefineries or gasification plants. But there will also be an increased demand from industries for solid biomass, both woodchips, pellets and bio-coal.

Many studies have been made to determine if these biomass volumes are available. A roadmap from Swedish Bioenergy Association came to the conclusion that there is a potential to increase the domestic bioenergy supply by 82 TWh in the mid-range and 147 TWh in the longer range (2050), based on available research and with ecological restraints. The potential to increase supply from forestry was calculated to be 42 – 74 TWh. There is also a large potential from agriculture.

A major part of the forest biomass potential is increased use of residues from harvesting operations, including thinning, and limited use of stumps. Of the maximum 74 TWh potential, 64 TWh would be classified as primary woody biomass with the definition proposed by ENVI. Only 10 TWh would be increased use of by-products from forest industry, a result of gradually increased harvested volumes due to increased forest growth. These by-products, defined as "secondary biomass" by ENVI, are already fully used for energy.

The conclusion is that a restriction for primary woody biomass would essentially stop the increase of forest biomass use, and thus threaten further substitution of fossil fuels in industry and transport.

The potentials for increased biomass from forestry and agriculture are based on research by Lund University (Börjesson). They are based on the assumption that the harvested wood is used in a similar fashion as today, and that industry has priority for the use of industrial quality wood.

Wood damaged by rot and therefore discarded

Slash from thinning

Use of primary forest fuels for advanced biofuel production

Sweden has high potential for production of biofuels from ligno-cellulosic feedstock, primarily from forest biomass, although also straw from agriculture is a possible source, but in much smaller volumes.

An increased use of forest residues (defined by ENVI as primary wood) is closely linked to several of the planned projects and production pathways. Here are some examples:

- Production of biodiesel from lignin is developed by Renfuel. Lignin will be extracted from black liquor in the pulp mills. The potential volumes are very large (10+ TWh/y). As black liquor currently is used as fuel in the pulp mill recovery boilers, the extracted lignin needs to be replaced by other biomass fuels. The plan is to use harvesting residues for this replacement.

- Pyrolysis oil from sawdust is already produced in full scale by Pyrocell at Kastet sawmill in Gävle (25,000 t/y). Similar units will probably be built in the near future at other sawmills. The pyrolysis oil will be up-graded to biofuels by Preem and other refineries. Sawdust is today also used as fuel at heat and power plants in district heating, and when more sawdust is used for biofuel production, this sawdust must be replaced by harvesting residues. In coming year, pyrolysis may also be applied to more complex biomasses, like chips made from harvesting residues.

- In Långsele, Uniper and Sasol plan to produce synthetic fuels from renewable hydrogen and biomass. The biomass will be gasified in a Fischer-Tropsch process and the produced fuel, 100,000 t/y, will primarily be SAF, sustainable aviation fuel. The reason for the location at Långsele, in the inland forest region, is the availability of low-quality forest biomass.

- Both in Örnsköldsvik and Uppsala, large quantities of biogenic CO_2 from combustion of woodchips will be used for production of synthetic fuels. The CO_2 will be captured from flue gases at large CHPs using both “primary” and “secondary” woodfuels. In Örnsköldsvik, Liquid Wind plans to produce methanol for maritime use, and the CO_2 from Uppsala will be used to produce aviation fuel at Forsmark by a consortium consisting of Vattenfall, Shell and LanzaTech. In both cases, renewable hydrogen will also be used.

- SCA, one of Sweden’s largest forest companies, plans a biorefinery for production of advanced biofuels at Timrå. No details have yet been published about volumes, but the plant will be based on forest residues from the region. Other Swedish Forest companies are looking into similar projects. The forestry cooperative Södra is building a first unit for production of cellulosic biofuels at Tofte in Norway in cooperation with Statkraft.

- Several utilities with CHPs are looking into production of biofuels as a complement to their production of heat and power. Växjö Energi (Veab) is one such company, which is looking into production of aviation fuels from biomass, cooperating with KLM.

For these projects, the supply of secondary wood fuels, as defined by ENVI, is limited. Instead, it is necessary to use residues from the forest, which today are not used. A ban on primary woody biomass, asdefined by ENVI, would effectively stop most of these projects.

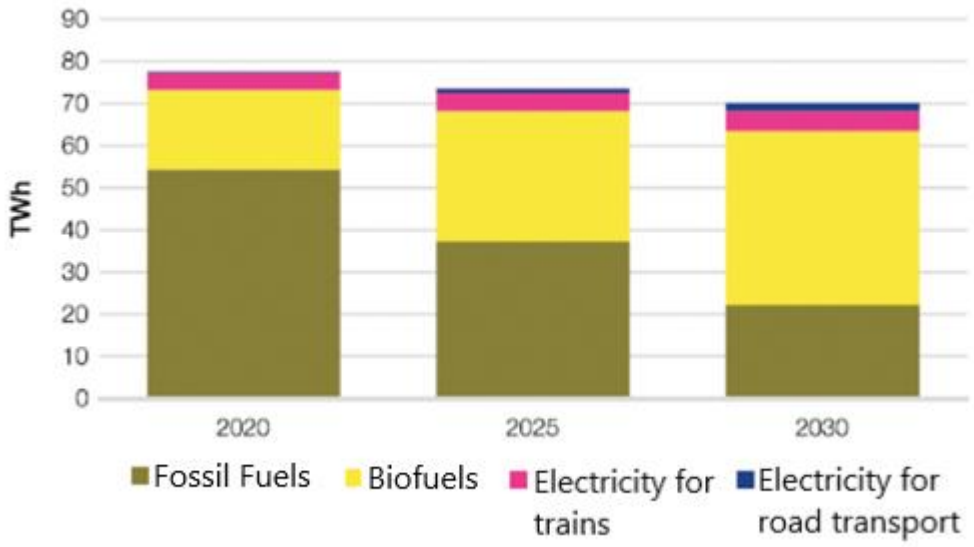


Illustration: Forecast for Swedish biofuel use until 2030

Energy use for domestic transport, including road, rail, air and sea transport modes. Red = electricity, yellow = biofuels. The demand for biofuels will more than double until 2030 to reach the target (Swedish Energy Agency).

Bio-CCS (BECCS) based on primary forest fuels

The emissions of biogenic CO_2 from large CHPs and pulp mills in Sweden is around 30 million tons. If these volumes can be captured, they can be used for BECCS and/or for BECCU, e.g. for production of synthetic fuels together with renewable hydrogen.

A governmental committee in 2020 proposed a plan to implement BECCS for 1.8 Mt CO_2 in 2030 and 3 – 10 Mt CO_2 in 2045. But the potential is much higher, and several companies have made feasibility studies. Some have already taken decisions to invest in BECCS.

Stockholm Exergy, the large utility in the city of Stockholm, has decided to be carbon neutral with negative emissions by 2026 using BECCS at its largest CHP Värtaverket. Around 800,000 tons CO_2 will be captured and stored from this plant, which uses only woodchips, mainly from forest residues transported to Stockholm by train and boat.

Other companies with BECCS or BECCU plans for negative emissions from forest residues are Växjö Energi, Söderenergi, Vattenfall, Mälarenergi and Övik Energi. In all these cases, instead of release of CO_2 in the forests when residues decompose, this biomass is used to substitute fossil fuels and with BECCS technology the CO_2 can be safely stored in the underground to create negative emissions. These companies will be able to offer their heat and power

costumers energy that is not only carbon neutral, but a concept that reduces CO_2 content in the atmosphere (negative emissions).

As about one third of the woody biomass used in Swedish CHPs are forest residues and discarded wood, defined as PWB by the EU Parliament, the potential for negative emissions from these plants will be reduced by one third. Some of these plants, like Värtan in Stockholm and the Växjö Energi CHP in Växjö, use almost solely PWB fuel.

Effects on biopower production for increased flexibility

The Swedish parliament has adopted a target of 100% renewable electricity production by 2040, not necessarily excluding nuclear power. In the coming years a very strong increase is expected in variable renewable power production, mainly wind power, both on-shore and off-shore, but also an increase in solar power.

With the increased share of variable power, there will be an increased need for planned power production using renewable fuels, both for balancing the grid, for peak load power production during winter days, and guaranteeing local capacity in big cities. Existing CHPs can be used, but new plants also need to be built, using both solid, gaseous and liquid renewable fuels. The current production of biopower is 14 TWh (2021), but the potential production in existing plants is around 20 TWh, if these plants run 5 000 h/y.

In a 100% power system with high share of wind power, the need for biopower could be as high as 40 TWh (according to study by Svebio), which would lead to the equivalent increased use of forest biomass.

Consequences for fire prevention

Due to active forest management during the last hundred years the frequency of forest fires has been very low in Sweden. But in recent years, possibly as a result of a warmer climate, more and larger forest fires have occurred. In 2014, around 14 000 hectares were affected in a large forest fire in Västmanland province. In 2018, around 25 000 hectares forest were lost in fires at 50 locations in north central Sweden - primarily Gävleborg, Jämtland, Dalarna and Västernorrland provinces. Compared to the total productive Swedish forest area, this is a small percentage, but the tendency for more fires is a concern, and there needs to be more focus on fire prevention.

Removing slash from harvesting sites and along roads, is one important preventive measure. Dry slash left in the forest can easily ignite and when fires have started the fires spread quickly in the dry slash. A restriction on removal of harvesting residues will clearly impede forest fire prevention and lead to higher economic losses from forest fires.

Sustainability for forest residues

The JRC report "The use of woody biomass for energy production in EU" clearly states that removal of slash below landscape threshold level gives positive carbon emissions mitigation even in the short term, especially in coniferous forests. The effect on biodiversity and ecosystem's conditions are assessed as neutral/positive. This category is in fact the woody biomass with the most positive evaluation among the 24 categories analyzed by JRC. The analysis does not, however, include industrial residues.

Chapter 5.8 of the report includes numerous references to research that confirm this conclusion looking into issues like habitat relevance, community composition, species populations, nutrient budgets, soil organic carbon and impact on productivity. The conclusions are based on 18 meta-studies (reviews, meta-analysis) which in turn are based on a much larger amount of studies.

A general conclusion is that removal of CWD (coarse woody debris) is more important than FWD (Fine woody debris), and that removal can be done up to thresholds, both for slash and stumps. Above these thresholds, some negative effects can occur.

The Swedish government has financed extensive research into environmental effects of biomass harvest for energy. A first such research program was led by the state owned energy company Vattenfall 1991 – 1998 (around 100 report of results). During 2011 – 2016, The Swedish Energy Agency financed a research program called Biomass Program Sustainability (Bränsleprogrammet hållbarhet 2011 - 2016). The results are described in a synthesis report 2018 (ER 2018:02).

Here are some of the conclusions concerning use of "primary biomass" (ENVI definition):

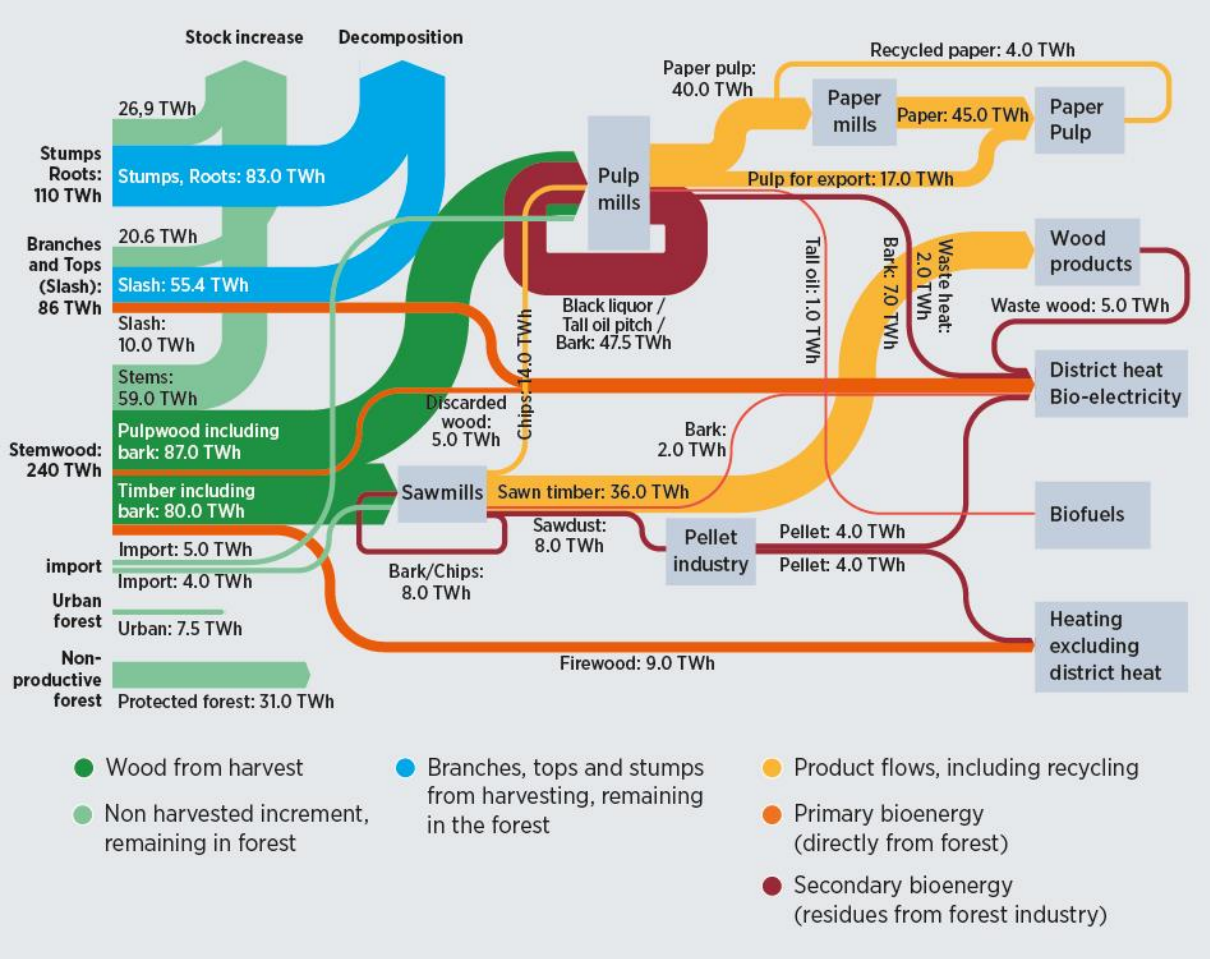
> "For sustainable forest production slash harvesting on 60% of the clear-cut areas was found to be acceptable. A higher harvesting proportion (80%) might, however, impact the possibility to reach forestry production goals."

> "A stump harvesting level of 30% was not considered to have negative impact."

The synthesis report considers impact of all the 16 environmental quality objectives adopted by the Swedish parliament.

Harvest of residues part of an integrated forestry-bioenergy system

The chart below shows the intricate forestry-bioenergy system in Sweden. The numbers are for 2015, and originally published in the IRENA report: Bioenergy from boreal forests – Swedish approach to sustainable wood use (IRENA 2019).



The numbers are expressed as energy values. The total energy production in Swedish managed forests were 436 TWh in 2015, which is more than the total energy use in Sweden (370 TWh in 2021).

- Dark green shows the harvested wood taken to industries.
- Light green shows the excess growth (increment minus harvest) which adds to the carbon stored in the forests and is reflected in LULUCF accounting.
- Blue shows the loss of carbon to the atmosphere through decomposition of unharvested residues in the forests.
- Orange shows residues from harvesting operations used for bioenergy (including traditional firewood). These flows are considered primary by the EU Parliament.
- Red shows residues from forest industries used for bioenergy, including recycled wood. These flows are considered secondary by EU Parliament.
- Yellow shows wood based industrial product.

As we can see in the chart, harvesting residues left in the forests have a total energy content of 148 TWh. Only 10 TWh slash is harvested. An increased harvest of at least 60 TWh is possible complying with RED sustainability criteria.

Instead of increasing this harvest, the proposal from EU Parliament means that the orange flows will be cut off, and there will be no increase of use of bioenergy from the blue flow. Instead, the flow of carbon (CO_2) from decomposition to the atmosphere will increase.

Effects on jobs and income

The biomass fuel chain for PWB gives employment and income, primarily in rural regions of Sweden. Studies have shown that each TWh of bioenergy creates around 300 jobs in the supply chain. A reduction of the use of PWB with 10 – 20 TWh would therefore jeopardize 3 000 – 6 000 jobs. Most of these jobs are spread throughout the country, mainly in rural regions with high unemployment rates and lower incomes.

In coming years, we foresee expansion in bio-based industries in a growing bioeconomy, to a large extent based on forest biomass. As we have shown in the chapter on advanced biofuels production, much of the increased use of biomass will be residues, defined as primary woody biomass. The total number of jobs created may be several thousands, and the establishment of these industries will have strategic importance for cities and regions with already established forest industry.

Sales of primary woody biomass also adds to the income for the 300 000 small-scale forest owners.

Annex A – Statistics

Current use of PWB in Sweden's energy system

Statistics Sweden publishes yearly statistics for the use of unrefined forest fuels. These statistics do not include black liquor, which is a major by-product at pulp and is combusted and used for internal energy needs in the mills.

Supply of unrefined forest fuels in Sweden 2015 – 2020 (GWh)

Year	Slash chips	Discarded wood	Firewood	**Total PWB**	byproducts	Recovered wood	**Total SWB**	% PWB
2015	9 033	6 104	9 327	**24 464**	26 061	5 694	**31 755**	43.5%
2016	9 236	6 864	9 567	**25 667**	25 914	4 800	**30 714**	44.8%
2017	8 504	7 150	9 602	**25 256**	26 828	5 166	**31 994**	44.2%
2018	9 229	5 904	8 113	**23 246**	26 605	5 357	**31 962**	42.1%
2019	8 921	5 926	7 705	**22 552**	28 893	5 692	**34 585**	39.5%
2020	7 828	5 202	7 698	**20 728**	28 606	5 640	**34 246**	37.7%

PWB = Primary woody biomass. SWB = secondary woody biomass. EU Parliament definitions.
Source: Statistics Sweden

The total use of unrefined woody fuels varied between 55 TWh and 57 TWh during these years, with the lowest use in 2020 (warm year). The definitions are not necessarily identical to the definitions used in Swedish statistics. What is here called "discarded wood" is called "stemwood chips" and "tree part chips". Most of these fuels originate from discarded wood at harvesting sites, like wood affected by rot, splinted wood, crooked, unwanted species, etc. But it can also be wood of pulp wood quality used for energy in situations when there is low demand or low prices on the market. Slash (in Swedish grot = branches and tops), includes slash from final cuts and thinning.

The unrefined forest fuels are used both for heat and power production in heat plants and CHPs. But they are also used in industries, mainly in sawmills and in pulp mills, but more and more also in other industries when these, due to the high Swedish carbon tax, convert their energy use from fossil fuels to biomass. Typical such applications are in food industry and laundries.

Use of unrefined forest fuels in district heating (2020) GWh

Fuel type	For heat production	For power production	Total use
Slash chips	6 130	2 405	8 535
Stemwood chips	3 230	666	3 896
Other unrefined	2 278	312	2 590
"Total PWB"	*11 638*	*3 383*	***15 021***
Bark	2 093	798	2 891
Sawdust	1 322	543	1 865
Recovered wood	4 003	1 942	5 945
"Total SWB"	*7 418*	*3 283*	***10 701***

Source: Energy Sweden (Energiföretagen)

These numbers don't correspond exactly with the official supply statistics above. The use of slash chips is larger than the supply above. The reason can be fuel storage, international trade. "Other unrefined" may to a large extent be secondary biomass, e.g. chips from sawmills (discarded wood).

Beside these categories there are also some amounts of biomass from stumps, from landscaping wood, from SRC coppice, etc. The total biomass use also includes the biogenic fraction of waste.

The use of wood fuels in district heating also included 2 098 GWh of refined wood fuels (pellets, briquettes and wood powder). The total use of wood fuels was therefore 27.6 TWh, and the total amount of bioenergy supplied to district heating was 39.6 TWh, and 45.4 TWh if the heat from flue gas condensation is included. Bioenergy accounts for 69 % of the energy supply to district heating/cooling and biopower production in CHPs. The use of fossil fuels in district heating was only about 1 %.

PWB accounts for around half of the woody biomass in district heating and about one third of the bioenergy use.

These shares may vary somewhat between the years. Our numbers are for 2020 which was a relatively warm year and a year with low electricity prices. Therefor the total fuel use was lower than usual.

Annex B

Harvesting practice of primary woody biomass in Swedish forestry

Residues are collected at harvesting sites after stemwood (saw wood and pulpwood) has been removed. The slash consists of branches, including twigs, and tops of trees, as well as smaller trees and bushes and unwanted species by the the industry. The slash is put in 3 – 5 meters high piles at roadside to dry during at least one summer season. The piles are partly covered with a layer of rough paper to keep some of the precipitation out. The moisture content goes down from 50% to 30%, which increases the energy value of the biomass considerably.

Some of the stemwood is also put in piles for “energy wood”. This is mainly discarded wood, like wood affected by rot, insects and other pests, splinted (snow and ice damage), charred, crooked, etc

A certain share of the slash is left at the harvest site, for different reasons. No slash is taken from very dry areas or very wet areas. Slash can also be used to bed the drive tracks to protect from soil damage.

A certain share of coarse dead wood must also be left at harvesting sides. It can be damaged or dry logs. Dry trees and old trees of certain broadleaf species are also regularly left et the harvest sites. Another way to create enough coarse dead wood is to leave high stumps.

Energy wood from thinning is another category. Special machinery can be used to harvest and collect small trees from thinning operations. Thicker stems can be used as pulpwood. The slash piles are chipped at roadside when biomass is needed at the nearby heat plants. The chips are loaded directly on trucks or in containers and taken to the heat plants or to terminals for transport by train or boat.

Damaged stemwood can be taken to heat plants to be stored, and later be chipped when fuel is needed. This kind of primary woody biomass offers fuel flexibility e.g at cold spells or when logistics are disturbed by bad weather conditions.

Annex C

Examples of combined heat and power plants using large quantities of PWB:

Stockholm Exergi
Värtan CHP using large quantities of PWB to heat central Stockholm

Stockholm Exergi supplies heat to the city of Stockholm and suburbs north of the city all the way out to Arlanda airport. Its largest combined heat and power plant (CHP) is located at Värtan in central Stockholm, 2 km from the city center.

In 2016, a new unit, KVV8, was inaugurated. It is the largest heat and power plants in northern Europe with a total capacity of 440 MW (150 MW electricity). The fuel use is 2.5 TWh and all the main part of the fuel is wood chips falling into the EU Parliament definition of primary woody biomass. Deploying flue gas condensation, the energy efficiency of the plant is close to 100 %.

KVV8 replaced an earlier boiler using coal, which was finally closed down in April 2020.
The wood chips used in Värtan KVV8 is supplied by train and boat from terminals in mid Sweden's forestry regions and from ports around the Baltic Sea. Stockholm Exergi Värtan is located by the harbor, and plant has underground storage areas for wood ships in former oil storage caverns. No biomass fuels to Värtan are supplied by trucks, due to the location in the inner city.

Besides supplying heat to 190 000 households in central Stockholm, the Värtan plant also produces 750 GWh electricity, a large share of the power needed in the city of Stockholm. This power supply is essential as baseload power and for stability in the local grid. As power lines into the city have limited capacity, this production is essential especially during cold winter days. The city can in fact be largely self-sufficient with power and heat in a crisis, due to bio and waste based combined heat and power.

Stockholm Exergi has decided to install BECCS technology on KVV8 by 2026. The removal of CO2 will be 800 000 tons, making the city of Stockholm carbon neutral, or even carbon positive by that time. A requirement for this to happen is continued use of biomass fuel.

Växjö Energi
Sandviksverket

Växjö Energi (VEAB) is the district heating supplier in the city of Växjö, located in southern Sweden. The city is a university town with a population of 70 000 people (100 000 in the whole municipality). It also has diverse industry and is a commercial and administrative center of the province. The region has some of Sweden's most productive forests, and Växjö also houses the head quarter of Södra, a forest owner's cooperative with 52 000 members all over south Sweden.

Växjö Energi produces heat and electricity at Sandviksverket, located relatively close to the city center. This plant was the earliest large heat plant to convert from fossil fuel (heating oil) to biomass, already in 1980. At the time, the main reason was to lessen Sweden's dependance on imported oil and use locally produced fuels like biomass and peat.

Since then, several large investments have been made at Sandviksverket, and new large units were inaugurated in 1996 and 2015. Each can produce 65 MW heat, 35-39 MW electricity and 35 MW heat from flue gas condensation, making the energy efficiency close to 100 %. Sandviksverket main fuel is woodchips from forestry, both by-products from sawmills and harvest residues from final felling and thinning. The forest biomass is supplied by thousands of forest owners, mainly farmers or descendants to farmers. For sawmills, sales of by-products offer an valuable extra income.

In coming years, VEAB has plans to develop the climate performance at Sandviksverket in several ways. In a cooperation with KLM and other partners, VEAB is looking into production of aviation fuels from forest biomass. This would develop the CHP into a biorefinery that not only produces heating/cooling and electricity, but also other biobased products. Another project is to capture carbon in flue gases for BECCS or BECCU. The total climate impact of these projects would be 280 000 tons of CO2 (negative emissions + substitutions effects).

A positive development of these projects depends on the availability of biomass. Restrictions on PWB would seriously stop the development, as forest residues stand for most of the potential to increase biomass volumes in the region. Växjö is actually located in the midst of a "wood basket" with very large remaining potential to increase the harvest of PWB meeting current EU sustainability criteria. (A detailed impact assessment has been produced by VEAB)

Kraftringen Lund
Örtofta CHP

Kraftringen supplies district heating and cooling to the cities of Lund and Eslöv, and to several other neighboring municipalities. The CHP at Örtofta, with a thermal capacity of 120 MW, between the two cities, was brought on line in 2014. The Örtofta CHP uses renewable/fossil free fuels including forest residues from fine woody debris/slash, saw dust, non-recyclable waste wood, heat pumps, biogas, bio-oil and waste heat. Although the southern province of Scania is primarily and agricultural region, there is also much forest with high growth rates and much residues from local forestry is available as fuel. Much of the forest is beech or other broadleaf species. Kraftringen sources the forest residues fuels within an average area of 80 km. Kraftringen has close contact with all its local fuel suppliers.

In addition, Kraftringen's CHP outside Lund supplies Sweden's only sugar production facility – Nordic Sugar - with 100 GWh renewable steam replacing natural gas. By supplying approximately 25% of Nordic Sugar's energy needs with renewable steam from Örtofta, carbon emissions are reduced by 17 000 tons/annum.

Kraftringen sees further possibilities to develop bio-based CHP with forest residues as part of the fuel mix (under threshold values and with local sourcing)

- It could add additional stable and predictable regional electricity production in the south of Sweden

- It could further increase the energy transition and decrease CO2-emissions in the Swedish food sector from approx. 400 GWh renewable steam

- Kraftringen's CHP has the potential to capture approx. 200 000 ton CO2 to negative emissions. With planned investments, Kraftringen has the potential to capture 400 000 ton negative emissions, which could contribute both to the Swedish and the European climate targets.

There is a regional lack of power capacity in southern Sweden, and biopower offers a major possibility to increase local and regional stable and predictable electricity production, also during wintertime when the demand is high. All of these developments could be jeopardized if new restrictions on PWB were introduced, as these fuels are a major part of the fuel supply at Örtofta.

In conclusion, if the competitive power of the regional CHP and district heating and cooling based on forest residues disappears, one of the bases of the Scandinavian and Swedish energy infrastructure model and its world-famous social contract on the provision of affordable and efficient key collective energy services, will be threatened.

Annex D

Proposal for a better categorization

A better categorization of biomass for energy could look like this:

1. Primary biomass.
   Biomasses from dedicated energy crops or from forest felling done solely for energy purposes. This includes energy crops like corn, sugarcane and rapeseed for biofuel production, energy grasses like Miscanthus and reed canary grass, short rotation coppice production, energy plantations (poplars and other fast-growing species), crops for biogas production, algae, etc.

2. Secondary biomass.
   Biomass residues from forestry, agriculture and fisheries, and connected industry, that are not the prime products. From agriculture in EU, large volumes come from straw, corn stover and manure. Globally, rice husks, bagasse and residues at palm plantations are examples of secondary biomass in large volumes. Food industries produce many types of residues. Woody residues can be both from harvesting operations, including from thinning, and from forest industry, like bark, sawdust, black liquor and tall oil. Discarded wood as well as wood from salvage logging can also be categorized as secondary biomass. If it is wished for, this category can be divided into two groups: residues from harvesting and residues from industry.

3. Tertiary biomass.
   Post-consumer biomass like recovered wood, demolition wood and the biogenic part of municipal waste. Even with a high degree of material recycling, all biogenic products eventually end up as waste when further recycling is not possible, due to fatigue and contamination. Sewage sludge also belongs to this category.

Svebio's position is that both primary, secondary, and tertiary biomass shall be used as bioenergy if the biomass fulfils sustainability criteria in RED and in national legislation. No caps or other limitations should be imposed to restrict the use when the sustainability criteria are met.