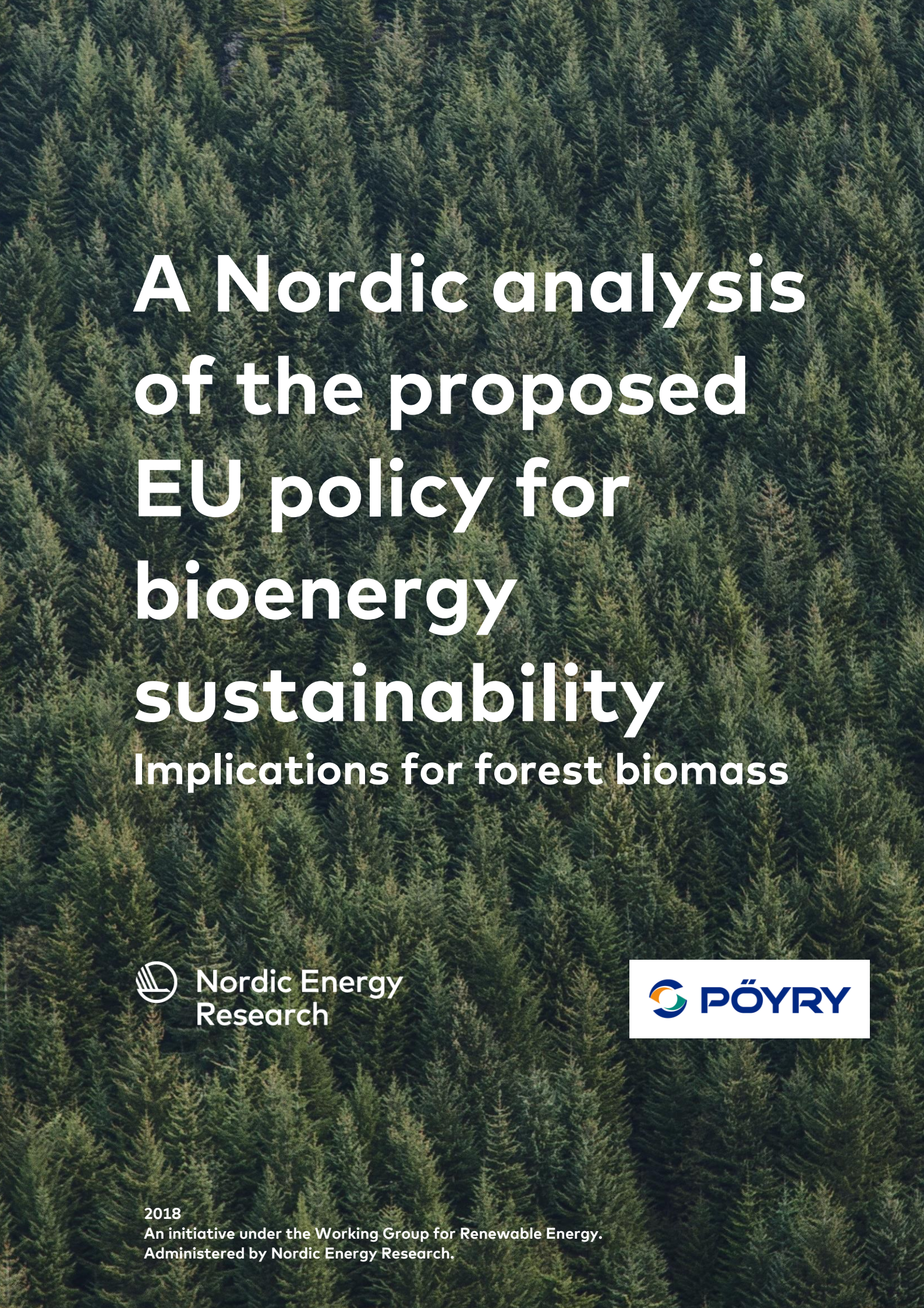

A Nordic analysis of the proposed EU policy for bioenergy sustainability

Implications for forest biomass

Nordic Energy Research

PÖYRY

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Nordic Energy Research
Nordic Energy Research is the platform for cooperative energy research and policy development under the auspices of Nordic Council of Ministers.

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FOREWORD

The following report is the result of a study undertaken by Pöyry Management Consulting on behalf of The Nordic Working Group for Renewable Energy (AGFE), who is working on behalf of the Nordic Council of Ministers.

This report is the result of a one-year process, starting when the proposal for a revised directive was launched in November 2016, and analysis going on in parallel with the EU negotiations. During the process, there have been two workshops with Nordic experts from industry and policy makers, allowing for discussion on what are the key issues for the Nordics and what are the implications on costs and market for forest based biomass. Thereby the work has contributed to the common understanding and Nordic collaboration in the ongoing transition to renewable energy.

The Nordic Working Group for Renewable Energy would like to thank all those who have participated in this process.

Stockholm, January 2018

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ENGLISH SUMMARY

This report provides analyses of the key aspects in the proposed EU policy for bioenergy sustainability focusing on the forest biomass used for heating, cooling and electricity generation and the implications on the Nordic countries. The work was commissioned by AGFE, the working group for renewable energy within the Nordic Council of Ministers and administrated by the Nordic Energy Research.

The basis for the assessment was the new forest biomass sustainability criteria in the RED II proposal presented by the European Commission in November 2016. In the proposal, a new risk-based sustainability criterion for forest biomass is introduced, as well as LULUCF requirement for ensuring proper carbon accounting of carbon impacts of forest biomass used in energy generation. The criterion also includes conversion efficiency and GHG saving requirements for new plants. The criteria would only apply to biomass-based heating/cooling and electricity installations with a fuel capacity of 20 MW or above. New plants starting operation after 2021 would be subject to more strict sustainability requirements than existing plants. Also, the secondary biomass would have lighter sustainability requirements than primary biomass. The criterion is currently being processed in the EU and the final version is likely to be ready during spring 2018.

Assuming that the content of the sustainability criteria remains mainly in the original form as presented in the RED II proposal, and that Nordic countries' forest biomass use will fulfill the country level criteria, implementation of the sustainability criteria is not expected to, according to the analysis carried out, significantly impact the overall forest biomass consumption in the Nordics. In addition, many stakeholders in the bioenergy industry welcome the new sustainability criteria due to expected stability in the industry's operating environment.

It does, however, increase the forest biomass fuel costs for the energy plants. The cost increase is estimated as 0.1-0.7 EUR/MWh (1-4%) of biomass fuel in case of low burden i.e. capacity threshold remaining at 20 MW and sourcing of forest biomass from country meeting the country level criteria. Most (85%) of this cost consists of additional burden for energy plants. The increase is expected to further impact the end use price of heat and/or steam, given that the competitive position of forest biomass compared to other fuels is not significantly changed. In case the cost cannot be transferred to prices of heat and/or steam, energy companies may have a rationale to lower the price for biomass paid for suppliers and further to forest biomass holders. If this is not an option, the additional costs are paid by energy companies.

The country level criteria are regarded as the most important aspect affecting the administrative burden and related costs. Sourcing of biomass from a country not meeting the country level criteria is estimated to increase the administrative cost by some >65%, i.e. 0.2 EUR/MWh of fuel compared to sourcing from a country meeting the country level criteria. Another important aspect is the plant capacity threshold of 20 MW. Lowering the threshold to e.g. 10 MW is estimated to increase the administrative costs by some >40%, i.e. 0.1 EUR/MWh of fuel. Application of the default GHG factors for new plants is estimated to impact on administrative burden by some >15%, meaning that application of own GHG calculations instead of default GHG values would increase the administrative cost by 0.04 EUR/MWh of fuel.

The cost impacts of the proposed sustainability criteria were assessed through a modelling of a hypothetical biomass market region, with a certain number of biomass holders, biomass suppliers and energy plants. The administrative burden for each part of the supply chain was assessed separately, resulting in administrative cost consisting of both one time and annual costs. The total cost was divided by the total amount of forest biomass used, resulting in an

estimate of the additional cost per one MWh of forest biomass used. The results are based on efficient supply chains using sustainable domestic biomass with no intermediate storages and no burden for forest owners. If these assumptions are not applied, the eventual administrative cost can be higher.

The sustainability requirements for the supply chain were assumed to originate from energy plants which need to demonstrate the compliance with the criteria to the state administration. In order to do this, energy plants were assumed to include sustainability requirements in their biomass supply contracts, transferring the responsibility for meeting the sustainability requirements for biomass suppliers. Further, biomass suppliers were assumed to transfer the responsibility to biomass holders i.e. sawmills or forest owners, as an example. The administrative cost potentially occurring for small scale forest owners were assumed to be carried out by biomass suppliers.

NORSK SAMMENDRAG

I denne rapporten presenteres analyser av hovedaspektene i den foreslåtte EU-lovgivningen for bærekraftig bioenergi, med spesiell vekt på biomasse fra skog som benyttes i oppvarming, kjøling og kraftproduksjon, og implikasjonene for landene i Norden. Rapporten er bestilt av AGFE, arbeidsgruppen for fornybar energi i Nordisk ministerråd, og administreres av Nordisk energiforskning.

Utgangspunktet for vurderingen er de nye bærekraftkriteriene for biomasse fra skog i forslaget til Fornybardirektiv 2, som ble presentert av EU-kommisjonen i november 2016. I forslaget lanseres et nytt, risikobasert bærekraftkriterium for biomasse fra skog i tillegg til et krav til bruk av jord og skog (The Land Use, Land Use Change and Forestry Regulation / LULUCF) som skal sikre riktig tallfesting av karbonutslipp knyttet til biomasse fra skog i kraftproduksjon. Dette kriteriet omfatter også krav til effektiv konvertering til energi og reduksjon i utslippene av drivhusgasser fra nye anlegg. Kriteriene gjelder bare for biomassebasert oppvarming, avkjøling og kraftproduksjon der kapasiteten er 20 MW eller høyere. Nye anlegg som settes i drift etter 2021, er underlagt strengere bærekraftkrav sammenlignet med eksisterende anlegg. Det stilles også mindre strenge krav til sekundær biomasse sammenlignet med primær biomasse. Kriteriene behandles for tiden i EU, og den endelige versjonen er sannsynligvis klar i løpet av våren 2018.

Hvis innholdet i bærekraftkriteriene i det opprinnelige forslaget til Fornybardirektiv 2 ikke gjennomgår vesentlige endringer, og forbruket av biomasse fra skog i enkeltlandene i Norden oppfyller kriteriene, viser analysen at det ikke forventes at implementeringen av bærekraftkriteriene i vesentlig grad kommer til å påvirke det samlede forbruket av biomasse fra skog i Norden. Dessuten stiller mange av interessentene i bioenergisektoren seg positive til de nye bærekraftkriteriene, ettersom det forventes at de kommer til å bidra til stabile arbeidsvilkår for bransjen.

Kriteriene medfører imidlertid økte kostnader for biomasse fra skog som brensel i kraft- og varmeanlegg. Den beregnede kostnadsøkningen er 0,1–0,7 EUR/MWh (1–4 prosent) for forbruk av biomasse ved lav belastning, dvs. at kapasitetsgrensen fortsatt er 20 MW, og at biomassen kommer fra land som er kategorisert som lav risiko. Størstedelen (85 prosent) av disse tilleggskostnadene bæres av kraftanlegg. Det forventes at økningen kommer til å gi utslag i prisen for oppvarming og/eller elektrisitet hos sluttbrukerne, ettersom konkurransesituasjonen for biomasse fra skog sammenlignet med annet brensel ikke har endret seg vesentlig. Hvis kraftselskapene ikke kan kompensere for kostnadsøkningen i prisene for oppvarming og/eller elektrisitet, taler dette for en prisreduksjon for biomassen de kjøper av leverandører, og hos produsenter av biomasse. Hvis dette ikke er et alternativ, må kraftselskapene selv dekke kostnadsøkningen.

Man anser at kriteriene for enkeltland kommer til å ha størst innvirkning på administrasjonskostnadene og relaterte kostnader. Ved bruk av biomasse fra et land som ikke oppfyller kriteriene på landnivå, forventes administrasjonskostnadene å øke med over 65 prosent, noe som tilsvarer 0,2 EUR/MWh for brensel, sammenlignet med kjøp fra et land som oppfyller kriteriene på landnivå. Et annet vesentlig aspekt er kapasitetsgrensen for anlegg på 20 MW. Hvis grensen for eksempel senkes til 10 MW, forventes administrasjonskostnadene å øke med over 40 prosent, dvs. 0,1 EUR/MWh for brensel. Det er anslått at standardfaktorene knyttet til drivhusgasser kommer til å medføre en økning i administrasjonskostnadene for nye anlegg på over 15 prosent. Dette vil si at bruk av egne beregninger for drivhusgasser i stedet for standardverdiene for drivhusgasser medfører en økning i administrasjonskostnadene på 0,04 EUR/MWh for brensel.

De kostnadsmessige konsekvensene knyttet til de foreslåtte bærekraftkriteriene er vurdert ved hjelp av modeller for et hypotetisk markedsområde for biomasse med et visst antall produsenter, leverandører og anlegg. Administrasjonskostnadene for hver part i forsyningskjeden ble vurdert separat, og analysene viser både engangsutgifter og årlige

kostnader. Den samlede kostnaden er delt på den samlede mengden biomasse fra skog som forbrukes, noe som gir et anslag for ekstrakostnaden for hver MWh biomasse. Resultatene er basert på en effektiv forsyningskjede som anvender bærekraftig nasjonal biomasse uten mellomlagring og uten kostnad for skogeiere. Hvis disse forutsetningene ikke stemmer, kan de administrative kostnadene være høyere.

I rapporten forutsettes det at bærekraftkravene for forsyningskjeden er knyttet til kraftanlegg som må dokumentere oppfyllelse av kriteriene til myndighetene. Dette innebærer at kraftanleggene må inkludere bærekraftkrav i leveranseavtalene for biomasse, slik at ansvaret for å oppfylle bærekraftkravene pålegges leverandører av biomasse. I tillegg forutsettes det at leverandører av biomasse pålegger det samme ansvaret på produsenter av biomasse, som for eksempel sagbruk og skogeiere. For mindre skogeiere forutsettes det at den potensielle økningen i administrasjonskostnadene dekkes av leverandørene av biomasse.

1. INTRODUCTION

1.1 Background

On 30 November 2016, the European Commission presented a proposal for a revised Renewable Energy Directive (COM(2016)767), later RED II, for the period of 2021-2030 within a broader Clean Energy package of proposals. The currently enforced EU Renewable Energy Directive (Directive 2009/28/EC), later RED I, lays down sustainability criteria for biofuels for transport and bioliquids used in other sectors but not for solid and gaseous biomass used for electricity, heating and cooling. The revised directive proposal reinforces the existing EU sustainability criteria for bioenergy by extending their scope to cover biomass and biogas for heating and cooling and electricity generation. This report provides analyses of the key aspects in the proposed EU policy for bioenergy sustainability focusing on the forest biomass used for heating, cooling and electricity generation and the implications on the Nordic countries. The works was commissioned by AGFE, the working group for renewable energy within the Nordic Council of Ministers and administrated by the Nordic Energy Research.

The European Parliament voted on the sustainability criteria on the 17th of January 2018. Next, the Renewable Energy Directive and the sustainability criteria will be discussed in the trilogues between the European Parliament, Council of Ministers and European Commission. After this, the process on the bioenergy sustainability criteria is expected to be finished during spring 2018.

1.2 Purpose of the study

The purpose of the study was to provide analyses of the key aspects in the proposed EU policy for bioenergy sustainability focusing on the forest biomass for heating, cooling and electricity generation and the implications on the Nordic countries.

The project aims to support Nordic countries

- to gain a common understanding of the consequences of the proposed sustainability policy;
- to contribute to the Nordic countries' internal biomass sustainability related processes; and,
- to contribute to the Nordic proactive action in the EU process.

The impact of proposed biomass sustainability criteria was assessed by considering the following key aspects:

- domestic feedstock: mobilisation, competitiveness and national legislation;
- imported biomass: availability and international trade of feedstock from third countries;
- administrative costs for different actors in the biomass supply chain;
- resource efficiency, in particular the implications of conversion efficiency requirement; and,
- implications on EU policy process, based on mutual consequences for the Nordic countries.

2. ROLE OF FOREST BIOMASS IN THE NORDICS

The role of forests and forestry varies between the Nordic countries. In Sweden and Finland, the forests cover major parts of the countries, reflected by the high level of roundwood removals, 73 million m^3 in Sweden and 59 million m^3 in Finland in 2015. In Norway, the mountain areas limit the forest cover and related roundwood removals which amount to 12 million m^3in 2015. In Denmark the forest cover is significantly lower than in the other Nordic countries, and thus also the roundwood removals were low compared to other countries, below 4 million m^3 in 2015 (National Statistics, year 2015[1]).

The importance of the forest sector is reflected by the share of biomass used in electricity and heat generation. According to IEA and Nordic Energy Research (2016)[2], in Finland, biomass accounted for 22% of the fuels used in electricity and heat production in 2013, also in Sweden the share was 18%. In Norway, biomass accounted for only 5% of fuel use. In Denmark, biomass accounted for 31% of the fuels used in electricity and heat production in 2013, despite the relatively small role of forestry and forest industry in the country.

The high share of biomass in Denmark is explained by the dependency on imported forest biomass. In 2015, imports represented 46% of the total biomass consumption in Denmark (Figure 11). Estonia, Latvia and Russia were the main sources for imported biomass to Denmark, consisting primarily of imported pellets. The role of imports is significantly lower in Sweden, Finland and Norway, where imports account only for some 2-4% of biomass use.

The future of forest biomass use in the Nordics depends on a variety of aspects, such as renewable energy policies implemented in each country, including measures to phase out fossil fuels, fuel taxation as well as renewable energy subsidies. In addition, forest biomass use is impacted by development of electricity market prices, price for emissions allowances under the EU emission trading scheme, need for heating, cooling and industrial steam as well as the development of forest industry and related roundwood harvesting and industry residue generation. Furthermore, possible policy measures to promote the use of advanced biofuels by 2030 may impact the allocation of forest biomass for heating, cooling and electricity generation in Nordic countries.

In Finland and Sweden, a majority of the large-scale biomass use consists of industry residues, the rest consisting of mainly by-products and residues from forestry and industrial roundwood harvesting, including small diameter roundwood from thinnings. In Denmark, pellets are the main type of forest biomass used for energy production. In general, forest biomass based bioenergy does not drive commercial forest harvesting in the Nordics, as typically wood sales for material use generates higher returns for forest owners. In terms of sustainability of forestry, voluntary forest certification schemes, either PEFC and/or FSC, are common in all the Nordic countries. In addition, national legislation and regulations are in place addressing aspects related to sustainability of forest management. Furthermore, Denmark has already developed a voluntary industry led sustainability scheme for forest biomass use in energy plants of 20 MW and above.

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[1] *Sweden: SKA15 -Roundwood harvesting (2015); Finland: Luke (2015) - teollisuuspuun hakkuut; Norway: Eurostat (2015) - Roundwood removals; Denmark: Statistics Denmark (2015) - Felling in forest and plantation in Denmark by species of wood, region and time*

[2] *International Energy Agency, Nordic Energy Research (2016). Figures refer to year 2013.*

3. RED II DIRECTIVE AND BIOMASS SUSTAINABILITY CRITERIA

3.1 RED II provisions

The RED II proposal introduces a risk-based sustainability criteria for forest biomass[3]. This means that countries meeting specific criteria fullfill the country level criteria with less detailed requirements to demonstrate sustainability compliance for biomass sourced from that country. In countries not meeting the country level criteria, sustainability compliance is required to be demonstrated on a forest holding level.

More specifically, the main provisions for ensuring the sustainability of forest biomass in the RED II proposal (article 26) include requirements for forest biomass to 1) be harvested in a sustainable manner (Paragraph 5, later "sustainability of harvesting" criteria) and to 2) ensure that carbon stocks and sink levels in the forest are maintained (paragraph 6, later "LULUCF" criteria). In new plants, forest biomass need to 3) deliver sufficient GHG savings compared to fossil fuels (Paragraph 7, later "GHG requirement" criteria), and 4) be converted into energy with high efficiency (Paragraph 8, later "conversion efficiency" criteria).

The sustainability criteria applies to biomass-based heating/cooling and electricity installations with a fuel capacity of 20 MW or above. Fullfillment of the sustainability criteria is required in order to contribute towards the EU target and member states renewable energy share and to demonstrate eligibility for financial support for the consumption of forest biomass fuels.

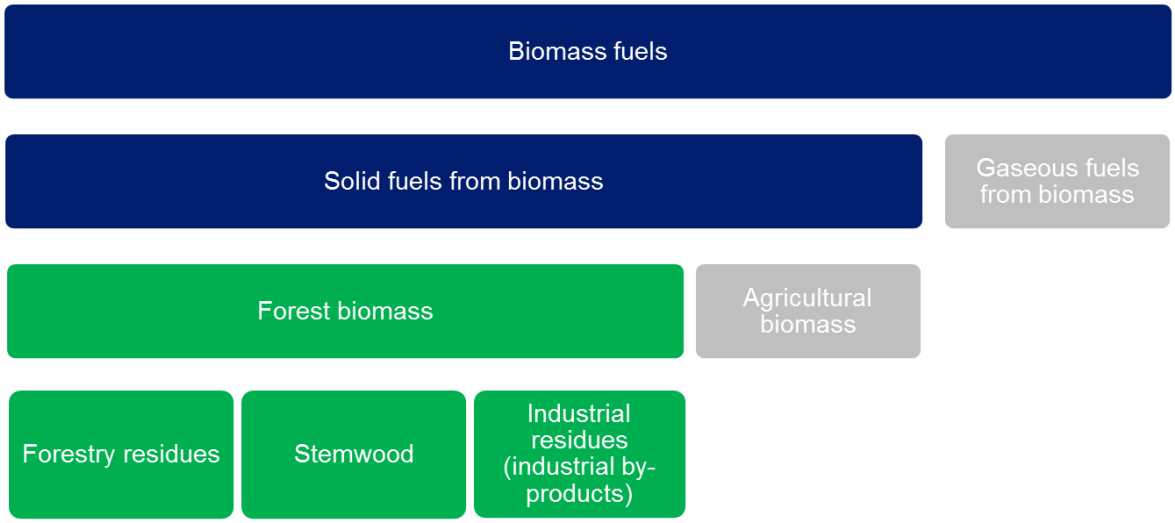
3.2 RED II interpretations and definitions

Criteria coverage – biomass assortments

The definitions for biomass fuels used in the RED II proposal are summarized in Figure 1. The focus of this project was to assess implications of the proposed sustainability criteria on solid forest biomass including forestry residues, stemwood and industrial residues/by-products used for electricity and heating/cooling, highlighted in green in Figure 1.

[3] *According to COM(2016)767 defined as biomass produced from forestry*

Figure 1 Biomass fuels in RED II



Source: COM(2016)767, SWD(2016)418 final

In the context of this project, the forest biomass is further divided into primary and secondary forest biomass. Primary forest biomass refers to biomass originating directly from forestry including wood chips from small trees harvested for energy purposes (e.g. pre-commercial thinnings), firewood or harvesting residues in the form of branches and tops or stumps. Secondary forest biomass refers to by-products from forest industries including assortments such as sawdust and bark.

Criteria coverage – forest biomass and operators

Based on the proposed sustainability criteria, the requirements for new energy plants using forest biomass are stricter than for existing plants (Figure 2). New plants are required to demonstrate compliance with the conversion efficiency and GHG requirement criteria for all forest biomass assortments used. Existing plants are not required to demonstrate these criteria and only need to demonstrate compliance with sustainability of harvesting and LULUCF criteria.

In addition, the requirements for primary forest biomass are stricter than those for secondary forest biomass. This means that the sustainability of harvesting and LULUCF criteria apply only to forest biomass originating directly from forests but not for industrial residues.

Figure 2 Forest biomass and operators covered in RED II

Existing installations

		Criteria			
		Conversion efficiency	GHG requirement	LULUCF	Sustainability of harvesting
Installations covered	*20 MW >*				
Forest biomass covered	*Primary forest biomass and pellets*				
	Secondary forest biomass and pellets				

New installations

		Criteria			
		Conversion efficiency	GHG requirement	LULUCF	Sustainability of harvesting
Installations covered	*20 MW >*				
Forest biomass covered	*Primary forest biomass and pellets*				
	Secondary forest biomass and pellets				

Sources: COM(2016)767, Pöyry interpretation

Based on the analysis of the criteria elements and stakeholder interviews on the interpretation of the criteria, the key aspects that need to verify the compliance with criteria include:

- Type of biomass (for secondary biomass);
- Country of origin (for primary biomass from a country fulfilling the country level criteria);
- Sustainability on a forest holding level (for primary biomass from a country not fulfilling the country level criteria); and,
- GHG impact (for all biomass used in new plants)

It is assumed that verification of the conversion efficiency criteria does not require additional verification by economic operator.

The eventual verification burden depends on the types of biomass used and the approach applied. For example, in terms of the GHG impact, operators can choose whether to use the default values provided by the RED II proposal, or own GHG calculations based on the methodology presented in the proposal. In general, there are a variety of combinations of sustainability aspects to be verified depending on the sourcing solution and type of energy plant as illustrated in Figure 3.

Figure 3 Requirements to demonstrate compliance with RED II sustainability criteria

Existing plants

Fuel		Country level criteria met	Country level criteria not met
Chips	Industry residues	Type	Type
	Forest biomass	Origin	Sustainability
Pellets	Industry residues	Type	Type
	Forest biomass	Origin	Sustainability

New plants, default GHG

Fuel		Country level criteria met	Country level criteria not met
Chips	Industry residues	Type + distance	Type + distance
	Forest biomass	Origin + feedstock + distance	Sustainability + feedstock + distance
Pellets	Industry residues	Type + distance + energy	Type + distance + energy
	Forest biomass	Origin + feedstock + distance + energy	Sustainability + feedstock + distance + energy

New plants, non-default GHG

Fuel		Country level criteria met	Country level criteria not met
Chips	Industry residues	Type + $GHG_{\text{industry plant – energy plant}}$	Type + $GHG_{\text{industry plant – energy plant}}$
	Forest biomass	Origin + $GHG_{\text{forest – energy plant}}$	Sustainability + $GHG_{\text{forest – energy plant}}$
Pellets	Industry residues	Type + $GHG_{\text{industry plant – pellet plant – energy plant}}$	Type + $GHG_{\text{industry plant – pellet plant – energy plant}}$
	Forest biomass	Origin + $GHG_{\text{forest – pellet plant – energy plant}}$	Sustainability + $GHG_{\text{forest – pellet plant – energy plant}}$

Sources: COM(2016)767, Pöyry interpretation

4. COMPLIANCE OF NORDICS WITH RED II SUSTAINABILITY CRITERIA

The sustainability criteria for forest biomass used for electricity, heating and cooling can be divided in two main categories: 1) sustainability criteria for primary forest biomass and 2) GHG savings and conversion efficiency criteria for new plants.

Based on the analysis of the key criteria elements and several stakeholder interviews (Appendix 3 – Organisations interviewed), a criteria compliance overview for the Nordic countries and for the main import countries from a Nordic perspective was formed. The main findings from the analysis are discussed in the following sections.

4.1 Sustainability criteria for primary forest biomass

The criteria for primary forest biomass include two main elements:

- criteria for sustainability of harvesting (RED II, article 26, paragraph 5); and,
- LULUCF criteria (RED II, article 26, paragraph 6).

The key aspect concerning the criteria for primary forest biomass is the question of whether the country of biomass origin fulfills the country level criteria or not, as this will impact the overall administrative burden faced by economic operators.

In this project, the criteria for primary forest biomass were compared to the prevailing conditions in Nordic countries and the main countries exporting forest biomass to Nordic countries i.e. Russia and the Baltic States. The purpose of this assessment was to evaluate the possibility of Nordic countries and main import countries to fulfill the country level criteria in order to estimate the overall administrative burden and biomass market implications.

Sustainability of harvesting criteria include five elements concerning harvesting permit, forest regeneration, protection areas, soil quality and biodiversity as well as long-term production capacity of forests. Out of these five elements three are formulated in a way that interpretation of the compliance remains uncertain to many stakeholders interviewed during the project. These elements include requirements of protection areas, impacts on soil quality and biodiversity as well as long-term production capacity of forests. These three elements were excluded from the analysis due to the interpretation issues, but the compliance with the harvesting permit and forest regeneration requirement was assessed.

In general, uncertainties were identified related to Nordic countries in terms of fulfilling the country level criteria, mainly regarding the sustainability of harvesting criteria (Table 1). Even if the existing local legislation and regulations address sustainability of harvesting aspects, it is not clear that Nordic countries meet the requirements largely due to differences in definitions between the proposed sustainability of harvesting criteria and local legislation and regulations. However, the Nordic countries are expected to fulfill the country level criteria in terms of the LULUCF criteria, but there are uncertainties related to Russia, which is one of the main sources of imported biomass to Nordic countries.

Table 1 Country level compliance with the criteria for primary forest biomass

	Sustainability of harvesting criteria		LULUCF criteria	
Sweden	Uncertainties e.g. related to harvesting permit definition		No uncertainties assuming that LULUCF is covered in the EU NDC by 2020	
Finland	Uncertainties e.g. related to harvesting permit definition		No uncertainties assuming that LULUCF is covered in the EU NDC by 2020	
Denmark	Uncertainties e.g. related to harvesting permit and forest regeneration definition		No uncertainties assuming that LULUCF is covered in the EU NDC by 2020	
Norway	Uncertainties e.g. related to harvesting permit definition		No uncertainties assuming that LULUCF is covered in the EU NDC by 2020	
Import countries	Uncertainties e.g. related to forest regeneration definition in Russia		Uncertainties related to ratification of Paris Agreement in Russia	

high compliance risks *some compliance risks* *minor compliance risks*

Sources: COM(2016)767, Pöyry analysis and interviews with stakeholders

The uncertainties related to the Nordic countries being able to fulfill the country level criteria are expected to mainly impact Sweden and Finland, where primary forest biomass plays an important role in several large-scale energy plants. In Norway, the role of primary forest biomass is small. Also in Denmark, the role of domestic primary forest biomass is small but a significant amount of forest biomass is imported from the Baltic Countries and Russia. Therefore, the uncertainties related especially to the LULUCF criteria in Russia are expected to complicate import operations to some extent. However, as a major part of imports to Denmark consist of pellets, possibly also secondary forest biomass is used, potentially implying lower dependency on Russia fulfilling the country level criteria. In addition, the existing voluntary sustainability scheme applied in Denmark can possibly be adjusted and applied to demonstrate the compliance on a forest holding level, if needed.

4.2 GHG saving and conversion efficiency criteria for new plants

The GHG saving criteria requires at least 80% emission savings compared to fossil fuels from the forest biomass used for electricity, heating and cooling in installations with a fuel capacity ≥20 MW starting operation from 2021 onwards. The requirement increases to 85% for installations starting operation from 2026 onwards.

Operators may choose to use default values presented in the RED II proposal to demonstrate compliance with the GHG saving criteria. Alternatively, operators may use their own GHG calculations based on the methodology presented in the RED II proposal in case default values show too low GHG saving, and sufficient GHG performance can be demonstrated for specific biomass supply chains.

In general, heat plants using domestic or imported non-pelletized forest biomass within a sourcing distance of 2500 km would not need to use own calculations as the default values generally demonstrate sufficient GHG saving for meeting both 80% and 85% GHG saving requirement. This is also the case for CHP plants starting operations before 2026, but after that the default values do not clearly indicate the compliance in some cases. However, within

a sourcing distance of 500 km, the default values demonstrate sufficient GHG saving also for CHP plants starting operations from 2026 onwards.

In terms of pellets, the default values are clearly stricter. The key is the energy solution used to produce pellets i.e. pellet produced by using grid power do not generally demonstrate sufficient GHG saving, with a few exceptions. On the other hand, the default values for pellets produced based on biomass CHP generally demonstrate sufficient GHG saving if sourced within 2500 km, in some cases even longer transport distances are possible.

In general, the default values are regarded as conservative according to the stakeholders interviewed during the project. In addition, the default values seem not to recognize country specific differences regarding electricity production structure, for example. Also, information on the assumptions used for defining the default values is regarded as limited. Therefore, new energy plants using pellets may need to rely on own GHG calculations to demonstrate compliance with the GHG saving criteria. Despite of this, it is possible that not all types of pellets meet the GHG saving criteria even if using own GHG calculations, especially those produced with fossil fuels and transported from long distances.

There is also a requirement on conversion efficiency in the proposed criteria stating that for the energy plants with a fuel capacity ≥20 MW, only high efficient cogeneration technology is eligible to meet the objectives of the renewable energy directive. The conversion efficiency criteria are not regarded as critical from the Nordic point of view as long as investments in biomass based electricity only generation are not made.

Both GHG and conversion efficiency criteria apply only for new plants. It should, however, be noted that the interpretation of a "new plant" is not clearly defined in the directive proposal. Therefore, existing plants with replacement investments might be subject to the GHG and conversion efficiency requirements.

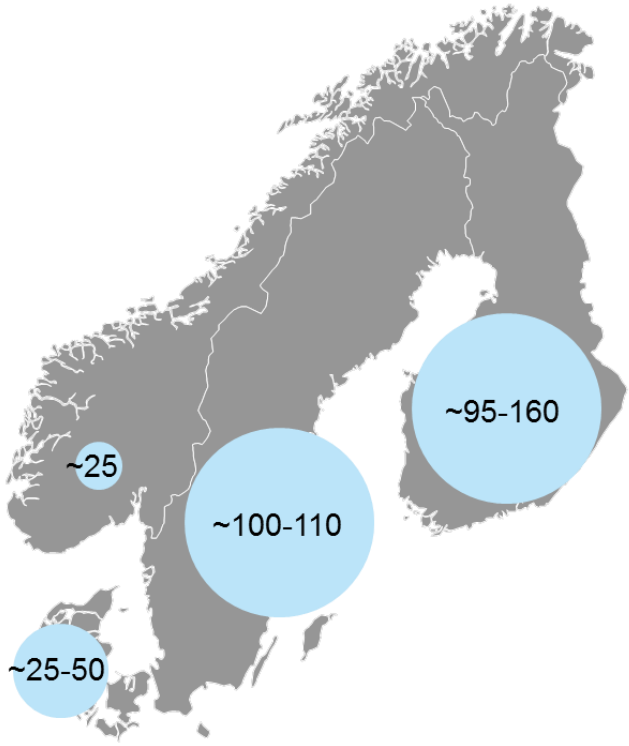
5. IMPLICATIONS FROM SUSTAINABILITY CRITERIA FOR NORDICS

5.1 Nordic energy plants impacted by the RED II sustainability criteria

The number of existing electricity and heat plants in the Nordics covered by the proposed sustainability criteria is more than 270 plants according to the analysis (Figure 4). A majority of these plants are located in Finland and Sweden indicating the highest country level burden from forest biomass sustainability criteria for those countries.

In general, many stakeholders in the bioenergy industry welcome the new EU sustainability criteria, as they are expected to clarify and harmonize the EU bioenergy markets and thus, stabilize the future operation and investment environment in the bioenergy sector.

Figure 4 Number of existing installations 20 MW or > to be impacted in the Nordics



Sources: Pöyry's database, interviews, public sources[4]

5.2 Administrative burden and cost

Methodology

The proposed sustainability criteria are expected to create an additional administrative burden for biomass supply chain, including forest biomass holders, biomass suppliers and energy plants (Figure 5). The cost for state administration and potential third parties were

[4] *Finland: Min: Pöyry boiler database that is based on public sources, Max: Interview with Energiavirasto – based on EU ETS plants data that incl. Installations using wood based biomass. Sweden: Min; Plants with installed capacity of chips > 20MW in Basis Bioenergy installations map, Max: estimate based largely on Svebio´s bioheat & bioelectricty maps. Denmark: Min: indicative information from Dansk Energi (2017), Max: Energistyrelsen (2014). Norway: NVE –information from 2015 incl. base load, peak load and reserve load.*

not included in the assessment. In this context, the cost of additional burden in the whole biomass supply chain was evaluated, including both onetime and annual cost for each of the players. The results based on the approach applied should be regarded as an estimate of a streamlined system for implementing the sustainability criteria in an efficient market environment.

The administrative cost was further defined on a unit basis for the amount of biomass used, resulting in an additional cost of biomass in EUR/MWh of fuel. The more detailed description of the methodology and assumptions used can be found in the Appendix 1 and Appendix 2.

Figure 5 Definition of administrative burden and cost

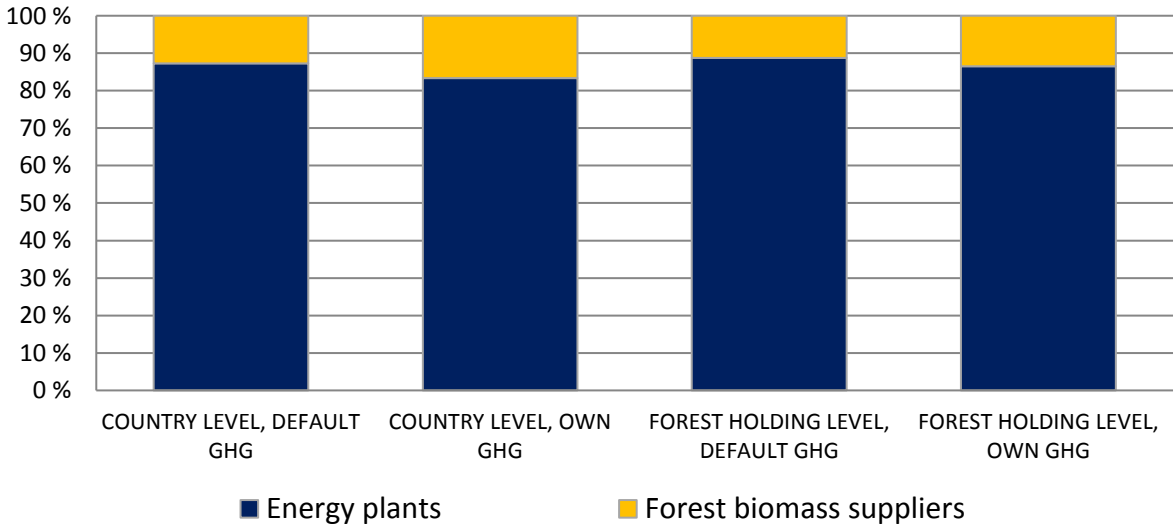
	Small scale forest owner	Fuel supplier	Energy plant
One time costs			
Contract update	-	X	X
System build-up	-	X	X
System approval	-	-	X
Annual costs			
System operation	-	X	X
Auditing	-	X	X

Sources: Pöyry analysis

Estimated administrative costs

Based on the analysis, about 85% of the system level administrative cost would be carried by the energy plants. Forest biomass suppliers would carry the rest of the cost (Figure 6). The cost burden share by player varies to some extent depending on whether the country level criteria or default GHG values can be used or not.

Figure 6 Average total administrative costs in the supply chain for plants 20 MW or over



Sources: Pöyry analysis

Based on the analysis, the total administrative cost for an average energy plant in the Nordics is estimated as 0.1-1.3 EUR/MWh of forest biomass fuel (Figure 7). The main aspects impacting the costs are the plant size and whether the country from which the biomass is sourced fulfills the country level criteria or not. The costs for small plants are the highest due to the relatively high fixed costs compared to the amount of biomass used. In addition, the costs are higher if biomass is sourced from a country not fulfilling the country level criteria than from a country fulfilling the country level criteria. The difference in costs between using own or default GHG values is regarded as relatively small.

Figure 7 Administrative costs per energy plant

Fuel capacity	Country level criteria met		Country level criteria not met	
	Default GHG	Own GHG	Default GHG	Own GHG
MW	EUR/MWh	EUR/MWh	EUR/MWh	EUR/MWh
10	0.7	0.8	1.3	1.3
20	0.4	0.4	0.7	0.7
40	0.2	0.2	0.4	0.4
60	0.2	0.2	0.3	0.3
100	0.1	0.1	0.2	0.2

Sources: Pöyry analysis

Key sensitivities

The results are sensitive to a few key assumptions applied in the assessment: Firstly, forest owners were assumed not to carry any of the administration costs. This is due to the assumption of access to existing systems advanced enough to 1) confirm the origin of biomass in case of sourcing from country fulfilling the country level criteria and 2) to confirm the validity of forest certification in case of sourcing from a country not fulfilling the country level criteria. In this case, the key assumption was that forest certification can be used and/or updated to meet the requirements of sustainability criteria. If not, then administrative actions may be required also from forest owners leading to more complex and expensive administrative costs.

Secondly, the biomass supply chains were assumed as efficient with no major intermediaries in addition to the biomass holder, biomass supplier and energy plant. In practice, biomass supply chains may include terminals or other intermediary storages potentially increasing the costs of administrative burden to some extent.

Thirdly, the biomass suppliers were assumed to supply all biomass batches according to the most strict sustainability requirements (new energy plants) even if some energy plants have less strict requirements (existing energy plants) or no sustainability requirements at all (small energy plants). This is based on an assumption that separate handling of biomass batches with a different sustainability status is more expensive than applying the strictest criteria for all the batches. In practice, this may not be the case for all the suppliers and the most relevant practices will eventually be defined on a company level.

Other considerations

The economic operators should use mass balance system to show that they fulfil the sustainability criteria. This can mean that biomass consignment/batch specific information should be available to show compliance with the criteria (RED II, Article 27). Having the batch

specific information available will allow tracking the batches back to the origin, i.e. forest or forest industry processing site to allow auditing and mass balance calculations.

Based on the interviews with biomass players, batch specific information is in most cases already available at least in Sweden and Finland where the biomass suppliers keep consignment/batch specific records including type of biomass, mass and origin information, and are able to further deliver this information to the biomass buyers. There may however be some extra costs related to the intermediate storing, if such are used, as the batches should be kept separate (at least unsustainable/non proof batches and sustainable batches). Also, when it comes to the imported biomass, the costs may be higher as the local conditions for keeping the records may not always be that developed.

Also, when auditing the batches, careful planning and instructing is needed when matching the mass balance at different supply chain stages. For example, forest biomass can be measured in solid cubic meters at road side, after chipping and in transport in loose cubic meters and at the energy plant site in energy unit. Additionally, some biomass is lost due to e.g. decay during the supply chain steps.

In the admin cost calculations made for this report, it is assumed that the energy plants will require the biomass suppliers contractually to deliver only sustainable biomass batches. The costs from keeping the mass balance records are, however, imbedded in the analysis as they are considered to be a part of the audit, system operation and IT system update costs. In the admin cost calculations, the intermediate storage related possible extra costs are not considered. Additionally, the admin cost is calculated for domestic biomass use only and the impact on the imported biomass is separately considered in the report. The reported costs also assume that forest owners would not be directly impacted by the criteria if they are forest certified, but the biomass buyers would carry the cost of ensuring the origin.

5.3 Market implications from administrative burden

The key impact from the administrative burden is the additional cost that increases the overall cost of using forest biomass in energy plants. This impacts the competitiveness of forest biomass especially in plants where other fuels are used together with forest biomass fuels. In case the competitive position of forest biomass changes, i.e. other fuels become more economic for energy plants to use, the demand for forest biomass may decrease. In case competitive position of the fuels is not changed, the additional cost lands on the forest biomass value chain.

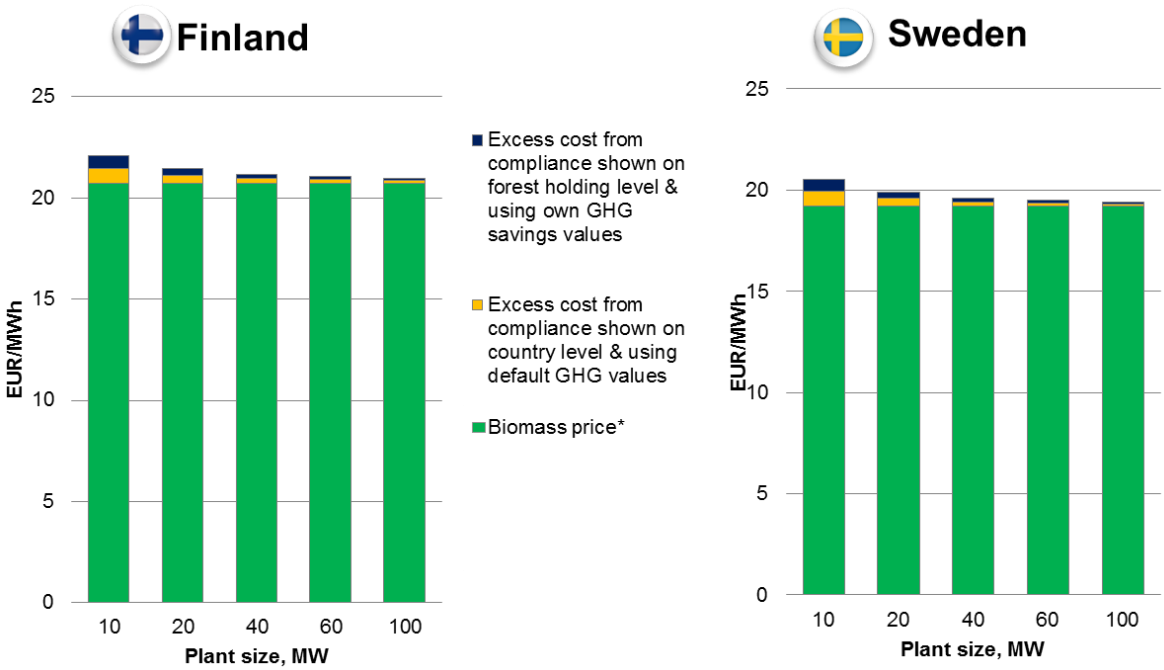
There is limited evidence available concerning the allocation of the additional fuel cost in the value chain. For example, district heating plants may have a rationale to allocate the increased cost to the end user price of heat. On the other hand, some energy plants, such as those supplying process heat or steam may not be able to use this option. In this case, there is an increased pressure to lower the biomass price paid to forest owners or, especially, forest industry companies supplying industry residues. There is, however, restricted potential for this due to possible adverse impacts on the willingness of biomass holders to mobilize forest biomass for energy use. In this case, energy companies need to carry the increased costs with impact on the overall financial performance of the energy sector.

5.3.1 Impact on domestic biomass cost

When comparing the administrative cost with the average biomass cost in Finland and Sweden, the cost impact is estimated as 1-7% depending on the size of a plant and sustainability approach applied. The relative cost impact increases significantly between fuel capacities of 20 to 10 MW, with 1-4% increase for 20 MW plants and 1-7% for 10 MW plants.

The relative impact is expected as slightly higher in Sweden than in Finland due to the lower average biomass cost. (Figure 8)

Figure 8 Implications on fuel costs – Example Sweden & Finland

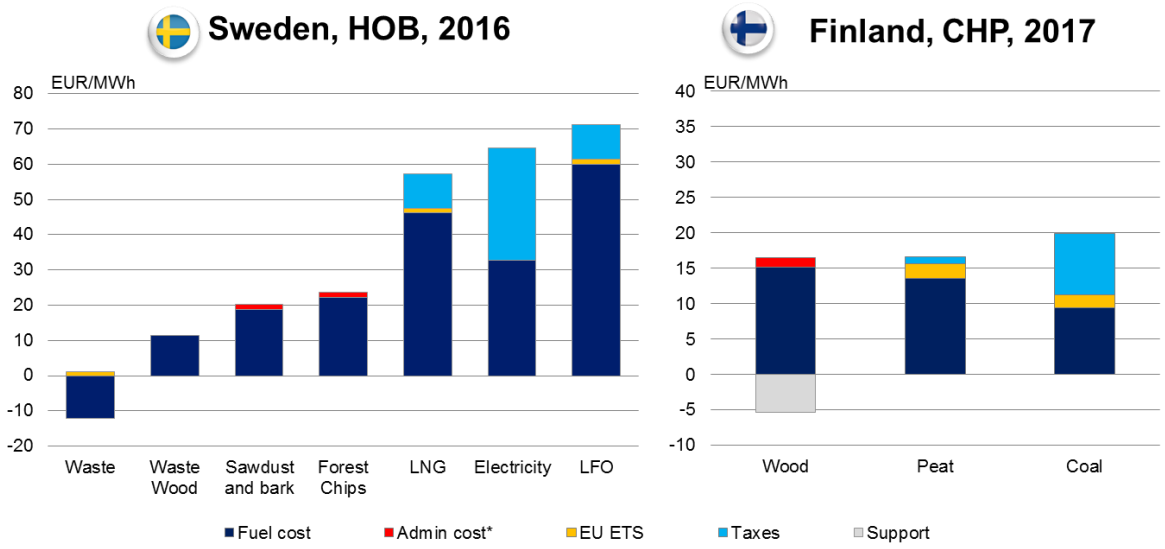


*Sources: Pöyry analysis.*Biomass prices: Finland: PIX Forest biomass (Forest chips, August 2017), Sweden: Forest chips, District Heating, Q2 2017, Energimyndigheten*

5.3.2 *Impact on fuel competitiveness*

Additional biomass cost is not expected to significantly change the competitive position of forest biomass in Sweden (Figure 9). In Finland, the additional cost may increase the use of peat in the short term, but it is likely that taxation and expected increase in EU ETS costs will balance the market in the long term.

Figure 9 Implications on biomass competitiveness – example Sweden & Finland



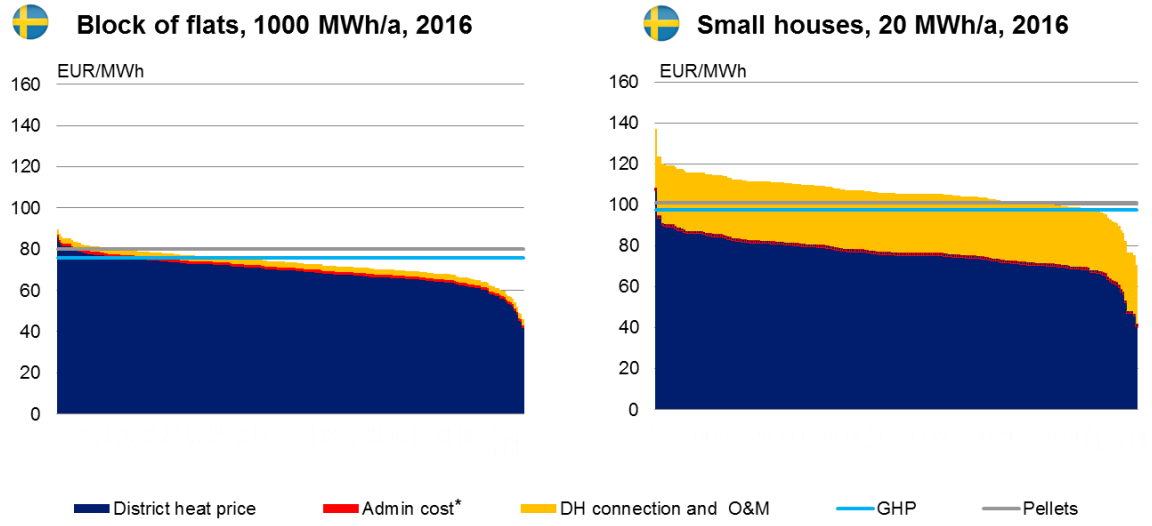
*Sources: Pöyry analysis based on public sources. *Admin cost: 10 MW plant, compliance shown on forest holding level & own GHG values used*

5.3.3 Impact on heating market

In Finland, Sweden and Denmark, district heating plants may have a rationale to transfer the increased fuel cost for forest biomass to district heating prices. In Norway, the additional forest biomass fuel cost is likely to be carried by the district heating player or energy plant, as the district heating prices are tied to competing electric heating costs. This may also be the case elsewhere if transferring the cost to end use price of heat/steam is not possible, or prices paid for biomass suppliers cannot be lowered due to mobilization risks.

Assuming that the estimated increase in forest biomass fuel costs would be passed on to district heating prices, it would slightly weaken the competitive position of district heating compared to other heating solutions, as illustrated for Sweden in Figure 10. The increase in the district heating price is not expected to significantly drive changes from one heating system to another, unless considering the most expensive district heating networks. In new buildings, however, the administrative cost added on district heating prices could to some extent enhance the competitive position of other heating solutions especially in mid to expensive district heating network areas.

Figure 10 Implications on heating market – example Sweden



*Sources: District heat prices: Energiföretagen: Fjärrvärmepriser 2015-2016. *Admin cost: 10 MW plant, compliance shown on forest holding level & Own GHG values used. Other analysis: Pöyry analysis based on industry sources.*

5.3.4 Impact on biomass use

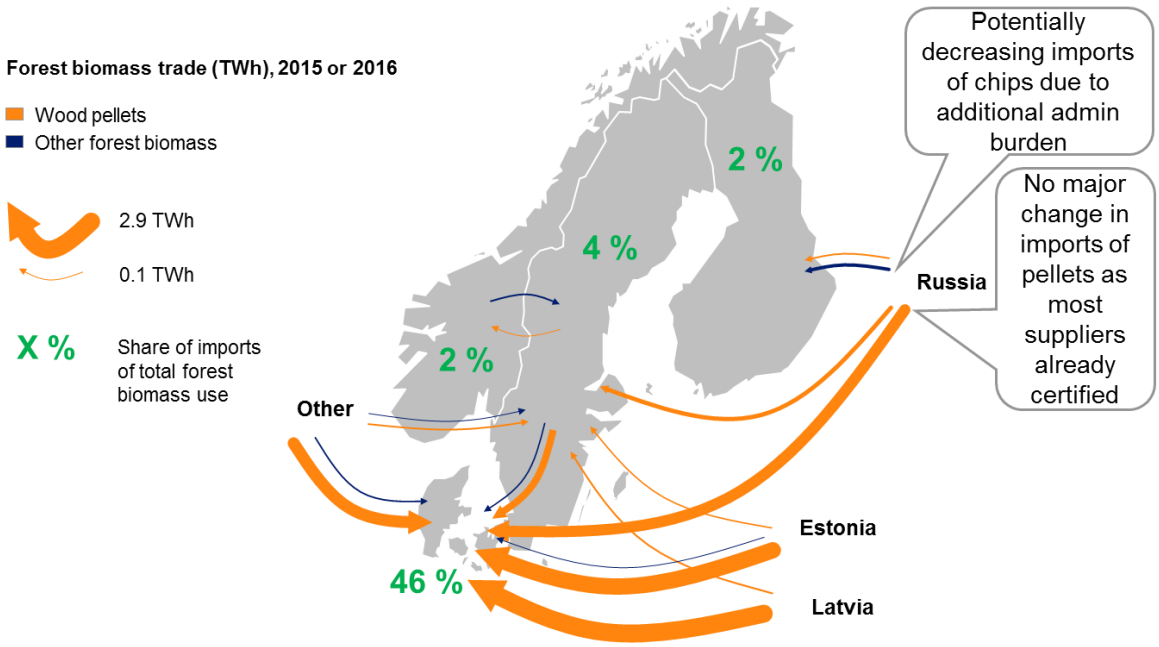
Assuming that the additional biomass cost impact remains at a level of 1-4% for energy plants covered by the proposed criteria, it is likely that implementation of the biomass sustainability criteria will not impact the forest biomass use in Nordic countries to a significant extent. The main reason for this is that the sustainability criteria are not expected to impact the competitive position of forest biomass in the long term. It does, however, increase the overall cost burden, but the impact of this on the overall biomass use is expected to remain low as the energy plants are assumed to have sufficient financial capability to carry the additional cost burden, in case increased forest biomass cost cannot be transferred to heat/steam or biomass market price.

However, the criteria may impact biomass import conditions, especially from Russia. The analysis shows that Russian forest biomass may not comply with the country level LULUCF criteria. This would likely add to the administrative burden and costs of Russian forest biomass somewhat.

At the moment, Denmark is the main Nordic country importing significant amounts of forest biomass, mainly in the form of wood pellets (Figure 11), part of that originating from Russia. In the other Nordic countries, the role of imported biomass is small, the share of imports being 2-4 % of total forest biomass use. The main forest biomass sources for the Nordics as a whole are Latvia and Estonia, whereas import from Russia plays a smaller role.

When it comes to the Danish energy plants using forest biomass, the existing voluntary sustainability scheme covers many sustainability aspects required in the RED II proposal. This reduces the sustainability risk assuming that the existing scheme can be adjusted and applied for imported biomass. Therefore, the impact of sustainability criteria on forest biomass imports to Denmark is expected to be limited.

Figure 11 Role of imported biomass and implications from administrative burden on the Nordic biomass imports



Sources: National statistic for imported biomass[5], National statistics for total biomass use[6], Pöyry analysis for implications

5.3.5 Other impacts

Beyond the Nordic countries, it is evident that the proposed sustainability criteria also impact other EU member states and sourcing conditions of existing and new plants in those countries with possible implications on Nordic countries. Assessment of these impacts was not covered by the scope of this assignment.

[5] *Statistics Sweden (2017). Imports of goods from all countries by commodity group CN 2,4,6,8 level and trading partner, confidential data excluded, not adjusted for non-response. Year 1995 – 2016. [CN codes used: 440110, 440131; data for 2016]; Statistics Demark (2017). Imports and exports by imports and exports, main Rev 4 SITC groups, country and unit (2007-2016). [SITC codes used: 24501, 24611, 24615, 24620; data for 2016]; Natural Resources Institute Finland (2017): Foreign trade in roundwood and forest industry products. Addition to source of wood chips: Pöyry estimate of use of imported chips in pulp industry (Report to the Ministry of Employment and the Economy). Rest goes to energy use. [data for 2015]; Statistics Norway (2017). Tabell: 08801: Utenrikshandel med varer, etter varenummer (HS) og land. [code 44011000 for fuelwood, 44013100 for pellets; data for 2016].*

[6] *Sweden: Swedish Energy Agency (2016): Produktion av oförädlade trädbränslen 2015. ES 2016:05, Pellets Förbundet (2017). Finland: Statistics Finland - Wood combustion in households and services 2015 & Energy use in manufacturing by energy source 2015, Luke - Solid wood fuel consumption in heating and power plants & Fuelwood consumption by small-scale housing by heating season and regional unit. Norway: SSB (2017), Eurostat (2017) & NoBio (2017). Denmark: Danish Energy Agency (2016). Grunddata 2015.*

6. CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Conclusions

The sustainability criteria are expected to impact mostly Finland and Sweden, where a majority of forest biomass energy plants covered by the criteria are located and the forest biomass consumption is high compared to other Nordic countries.

Therefore, the total cost of implementing the sustainability criteria on a country level is expected to be as high in Finland and Sweden. Denmark is expected to benefit from the existing national voluntary sustainability scheme which is potentially adjustable and applicable to demonstrate the compliance with the RED II sustainability criteria. In Norway, the role of forest biomass and thus the total cost are expected to be relatively small.

Assuming that the content of the sustainability criteria remains mainly in the original form as proposed in the RED II proposal, and that Nordic countries' biomass use will fulfill the country level criteria, implementation of the sustainability criteria is not expected to significantly impact the overall forest biomass consumption in the Nordic countries. It does, however, increase the forest biomass fuel costs for the energy plants with possible impact on district heating prices, forest biomass market prices and/or profitability of energy companies.

There are, however, uncertainties related to the interpretation and related impacts of the proposed criteria. The main uncertainty concerns the hypothetical situation where Nordic countries do not fulfill the country level criteria. In the sustainability criteria, there is no clear guidance for demonstration of compliance on a forest holding level in case of not fulfilling the country level criteria. Therefore, market impacts from implementation of the proposed sustainability criteria may differ from that presented in this report, especially if existing forest certification cannot be applied or is not sufficient.

The results and implications presented in this assessment concern Nordic countries but not individual companies. Even if some of the conclusions show relatively modest impacts for the Nordic countries, the situation for individual companies and energy plants might be different. For example, individual energy companies importing primary forest biomass from Russia may need to be prepared to revise their biomass sourcing strategies. In addition, IT- and other systems need to be revised or built, requiring significant effort for some of the companies. In general, large companies are expected to be better positioned to implement the required changes compared to smaller companies.

6.2 Policy implications

To demonstrate the sustainability of biomass used in the Nordic energy sector, and at the same time to minimize the administrative burden and related cost for the biomass supply chain, there are a few key items in the sustainability criteria that will have the most impact on the eventual burden, based on the original content and approach presented in the RED II.

Firstly, maintaining the risk based approach and option for Nordic countries to fulfill the country level criteria are expected to have the largest impact on administrative costs. Not fulfilling the country level criteria is estimated to increase administrative cost by >65% compared to the case where the country level criteria is met, indicating the additional burden of demonstrating sustainability on a forest holding level based on existing certification schemes. In case Nordic countries will not meet the country level criteria proposed, changes in forestry legislation and/or regulations may be needed to avoid the categorization as a country not fulfilling the country level criteria. Otherwise the additional cost will mostly land on the players in the forest biomass value chain.

Secondly, the plant capacity threshold of 20 MW can be regarded as reasonable from the administrative point of view as the relative burden for smaller plants is higher due to the fixed cost independent of the amount of biomass used. In other words, reducing the threshold to

10 MW is estimated to increase the administrative costs by >40% compared to the case where threshold is 20 MW. It is recognized that the proposed sustainability criteria do not cover small plants and, at least in theory, usage of non-sustainable biomass in small plants is possible even after implementation of the sustainability criteria. However, large biomass suppliers that serve several biomass plants, including those beyond the coverage of the criteria, may have a practical rationale to arrange all biomass deliveries to meet the criteria at least on a regional level. This, in turn, is expected to decrease the risk of using unsustainable biomass in plants smaller than 20 MW.

Thirdly, new plants that need to demonstrate the compliance with the GHG reduction criteria, are expected to face less burden if default values can be used instead of own calculations. Even if the proposed criteria include default values for several biomass types, widening the range of biomass assortments may be needed to improve the applicability of the default values. This would also mean recognition of country specific differences e.g. in the assumed emissions from electricity generation. However, the impact of using own GHG calculations instead of default values on administrative costs is expected to be >15%.

APPENDIX 1 - Methodology for definition of the administrative burden

The administrative implications and cost of the biomass sustainability criteria were assessed for the forest biomass supply chain i.e. biomass holders (forest owners/industry residue origin), biomass suppliers and energy plants (producing electricity and heat). The implications and cost concerning state administration and possible other parties, e.g. certification organizations were not included in the analysis.

As there are no similar sustainability criteria implemented elsewhere, the administrative implications were assessed based on a system modelling approach i.e. through modelling a hypothetical biomass supply region (country) with certain number of players (energy plants, biomass suppliers, sawmills and forest harvesting sites per year).

The system modelling approach allows elimination of a possible double-counting error as large biomass suppliers may serve several energy plants. This involves assumption of a system efficiency i.e. biomass suppliers were assumed to be exposed to one-time administrative burden serving requirements of several energy plants instead of multiple burden required by several energy plants served.

The parameters for Finland were used in defining the assumptions for the hypothetical biomass supply region due to the availability of information (e.g. availability of information on the number of energy plants with a capacity lower than 20 MW) as well as experience in implementation of regulatory sustainability criteria for wood based bioliquids.

The administrative burdens were defined for both primary and secondary forest biomass in non-processed form as these are the most commonly used biomass types in large energy plants in the Nordic countries (except Denmark). Many plants use both primary and secondary biomass and thus, the system modelling approach enables a holistic approach in considering the eventual administrative burden.

Definition of administrative burden

As a first step, the potential administrative actions required by each supply chain players (energy plants, biomass suppliers and biomass holders) were defined. The sustainability requirements for the supply chain were assumed to originate from energy plants that need to demonstrate the compliance with the criteria to the state administration.

In order to demonstrate the compliance, energy plants were assumed to include sustainability requirements in their biomass supply contracts, transferring the responsibility for meeting the sustainability requirements for biomass suppliers. Furthermore, biomass suppliers were assumed to transfer the responsibility to biomass holders i.e. sawmills or forest owners, as an example.

The content of the sustainability requirements transferred in the supply chain depends on the situation i.e. whether biomass is sourced from a country fulfilling the country level criteria or not, whether secondary or primary forest biomass is used, or whether biomass is used in a new or existing energy plant.

The administrative actions were defined for the following cases:

- Type of plant: New plants and existing plants
- Capacity threshold of the plants covered by sustainability criteria: 20 MW and 10 MW (fuel capacity)
- Origin of biomass: country fulfilling and not fulfilling the country level criteria. The following table shows if a country fulfils country level criteria, and is named as "Low Risk" and a forest holding level verification would be needed, names as "High Risk".
- GHG accounting method: Default values and own GHG values.

This gives 16 combinations of potential administrative actions needed, allowing identification of the possible burden range (low burden and high burden).

Definition of administrative costs and market implications

After defining the administrative actions needed, the cost of them was defined. The costs were assumed to consist of two elements, one-time and annual costs.

One-time costs were assumed to occur during the first year when the sustainability requirements are introduced, and consist of IT–system build-up/update, biomass supply contract updates and system approval from authority. The one-time costs were annualized to sum up with the annual cost. Annual costs were assumed to consist of system operation, maintenance and reporting, as well as annual auditing.

Each of the cost items were defined separately for each biomass supply players (energy plants, biomass suppliers, biomass holders). In terms of small scale forest owners, the costs were assumed to be carried out by a biomass supplier i.e. the organisation buying the biomass from forest owners. All the other players were assumed to carry their own costs. The total annual costs were divided by the total amount of biomass used, resulting in the estimate of the cost per MWh of biomass used.

APPENDIX 2 - ADMINISTRATIVE BURDEN – CALCULATION ASSUMPTIONS

Assumptions on forest biomass consumption

	EXISTING & NEW PLANTS		EXISTING PLANTS		NEW PLANTS		Assumption
Demand for primary biomass	14 500 000		11 000 000		3 500 000		m3, existing plants: 2020 volume, new plants: difference between 2030 and 2020 volume. Based on Finnish National Energy and Climate Strategy for 2030 (2017), reference scenario.
Demand for secondary biomass	10 500 000		9 500 000		1 000 000		
	10 MW>	20 MW>	10 MW>	20 MW>	10 MW>	20 MW>	Unit
Primary and secondary biomass used in energy plants of certain size classes	90 %	80 %	90 %	80 %	90 %	80 %	% of total national volume in Finland, 2030. Based on data in Pöyry boiler database and national statisctic.
Demand for primary biomass, in plant size classes	13 050 000	11 600 000	9 900 000	8 800 000	3 150 000	2 800 000	m3, 2030
Demand for secondary biomass	9 450 000	8 400 000	8 550 000	7 600 000	900 000	800 000	m3, 2030
Amount of forest biomass, total	45 000 000	40 000 000	36 900 000	32 800 000	8 100 000	7 200 000	MWh, 2030 (assumed: 2 MWh/m3 forest biomass)
Primary biomass, share of total	100 %	100 %	76 %	76 %	24 %	24 %	%
Secondary biomass, share of total	100 %	100 %	90 %	90 %	10 %	10 %	%

Assumptions on forest auditing

	Size class, existing & new plants		Assumption
	10 MW>	20 MW>	unit
Amount of secondary forest biomass harvested per stand	60	60	m3/ha, Finnish Forest Research Institute
Number of stands where forest chips are harvested	217 500	193 333	number of stands
Share of audited forest stands per year	0.10 %	0.10 %	share of stands audited/year, Pöyry estimate
Number of stands audited/year	218	193	number of stands audited/year

Assumptions on time requirement and system approval costs per energy plant

			EXISTING PLANTS								NEW PLANTS							
			>10 MW				>20 MW				>10 MW				>20 MW			
COST TYPE	COST ITEM	DEFINITION	LOW RISK, DEFAULT GHG	LOW RISK, OWN GHG	HIGH RISK, DEFAULT GHG	HIGH RISK, OWN GHG	LOW RISK, DEFAULT GHG	LOW RISK, OWN GHG	HIGH RISK, DEFAULT GHG	HIGH RISK, OWN GHG	LOW RISK, DEFAULT GHG	LOW RISK, OWN GHG	HIGH RISK, DEFAULT GHG	HIGH RISK, OWN GHG	LOW RISK, DEFAULT GHG	LOW RISK, OWN GHG	HIGH RISK, DEFAULT GHG	HIGH RISK, OWN GHG
ANNUAL COST	AUDITING	days/energy plant required (50% by auditor, 50% by energy plant)*	4	4	5	5	4	4	5	5	4	5	5	6	4	5	5	6
	SYSTEM OPERATION	days/energy plant for system maintenance and reporting*	25	25	45	45	25	25	45	45	25	30	45	60	25	30	45	60
ONE TIME COSTS	CONTRACTS	Contract update days/energy plant*	10	10	20	20	10	10	20	20	10	15	20	25	10	15	20	25
	IT SYSTEM	IT system build-up/update days/energy plant*	20	20	40	40	20	20	40	40	20	30	40	50	20	30	40	50
	SYSTEM APPROVAL	System approval by authority, EUR/energy plant**	5 600	5 600	7 200	7 200	5 600	5 600	7 200	7 200	5 600	6 400	7 200	8 000	5 600	6 400	7 200	8 000
	SYSTEM APPROVAL	System approval audit cost, EUR/energy plant**	1 750	1 750	2 250	2 250	1 750	1 750	2 250	2 250	1 750	2 000	2 250	2 500	1 750	2 000	2 250	2 500

**Based on Pöyry estimate and biomass supplier interviews*
***Estimate based on existing sustainability system for bioliquids in Finland (solid forest biomass based raw material), source: Finnish Energy Authority & Pöyry interpretation*

Assumptions on time requirement per biomass supplier

			EXISTING PLANTS								NEW PLANTS							
			>10 MW				>20 MW				>10 MW				>20 MW			
FOREST BIOMASS SUPPLIER TYPE	COST TYPE	DEFINITION	LOW RISK, DEFAULT GHG	LOW RISK, OWN GHG	HIGH RISK, DEFAULT GHG	HIGH RISK, OWN GHG	LOW RISK, DEFAULT GHG	LOW RISK, OWN GHG	HIGH RISK, DEFAULT GHG	HIGH RISK, OWN GHG	LOW RISK, DEFAULT GHG	LOW RISK, OWN GHG	HIGH RISK, DEFAULT GHG	HIGH RISK, OWN GHG	LOW RISK, DEFAULT GHG	LOW RISK, OWN GHG	HIGH RISK, DEFAULT GHG	HIGH RISK, OWN GHG
PRIMARY	ANNUAL COST	Auditing days/supplier required (50% by auditor, 50% by player), supplier audit*	4	5	5	6	4	5	5	6	4	5	5	6	4	5	5	6
PRIMARY		Auditing days/supplier required (50% by auditor, 50% by player), per forest stand*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SECONDARY		Auditing days/supplier required (50% by auditor, 50% by player), supplier audit*	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3
PRIMARY	ANNUAL COST	days/supplier needed for system maintenance and reporting*	4	6	8	10	4	6	8	10	4	6	8	10	4	6	8	10
SECONDARY			3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4
PRIMARY	ONE TIME COSTS	Contract update days/supplier needed (with forest owner)*	10	12	14	16	10	12	14	16	10	12	14	16	10	12	14	16
PRIMARY	ONE TIME COSTS	IT system build-up/update days/supplier needed*	20	30	40	50	20	30	40	50	20	30	40	50	20	30	40	50
SECONDARY			0	10	0	20	0	10	0	20	0	10	0	20	0	10	0	20

**Based on Pöyry estimate and biomass supplier interviews*

APPENDIX 3 – ORGANISATIONS INTERVIEWED

Organisation	Country	Type of a player
Hofor	Denmark	Energy Industry
Energiavirasto	Finland	Public organisations/State
Fortum	Finland	Energy Industry
Vapo Oy	Finland	Biomass supplier
L&T Biowatti Oy	Finland	Biomass supplier
FSC Finland	Finland	Certification
UPM	Finland	Biomass supplier
Energimyndigheten	Sweden	Public organisations/State
Brevens Bruk AB	Sweden	Biomass supplier
Skogsstyrelsen	Sweden	Public organisations/State
Latvian biomass association LATbio	Latvia	Biomass supplier industry
Norwegian University of Life Sciences	Norway	Public organisations/State
Norwegian Bioenergy Association	Norway	Energy Industry
VTT Technical Research Centre of Finland Ltd	Finland	Public organisations/State
Ministry of Environment	Finland	Public organisations/State
Metsäteollisuus ry	Finland	Biomass supplier industry
Energiateollisuus ry	Finland	Energy Industry
Sustainable Biomass Program (SBP)	International	Certification
Energiföretagen	Sweden	Energy Industry
Skogsindustrierna	Sweden	Biomass supplier industry
Dong Energy	Denmark	Energy Industry
Ministry of Environment and Food of Denmark	Denmark	Public organisations/State
Dansk Energi	Denmark	Energy Industry
Ministry of Environment, Estonia	Estonia	Public organisations/State
Ministry of Agriculture and Forestry	Finland	Public organisations/State
Permanent Representation of Latvia to the EU	Latvia	Public organisations/State
Landbruks- og matdepartementet (LMD)	Norway	Public organisations/State
Skogsstyrelsen	Sweden	Public organisations/State
Näringsdepartementet	Sweden	Public organisations/State

Nordic Energy Research

A Nordic analysis of the proposed EU policy for bioenergy sustainability

Implications for forest biomass

New forest biomass sustainability criteria were proposed in the revised EU Renewable Energy Directive, presented by the European Commission in November 2016. These criteria are highly relevant for the Nordic countries as producers and users of forest biomass for heating, cooling and electricity generation.

While the Nordics can expect some increased cost and administrative burden, we are well positioned for meeting the new EU sustainability criteria for sustainable biomass.

This report identifies the key aspects of relevance for Nordic forest-based biomass and provides analyses of the new risk-based sustainability criterion for forest biomass, the LULUCF requirement for ensuring proper carbon accounting of carbon impacts of forest biomass used in energy generation, and conversion efficiency and GHG saving requirements for new plants.

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