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Baltic ForBio

Activity 2.1 Report

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Preword

This report is the first report from the Interreg Baltic Sea Region (BSR) project "Baltic ForBio". It is an output of the Group of Activities 2.1 (GA 2.1) which aims to increase the involved partners´ understanding of the bioenergy market and the policies affecting it.

The project is financed by the European Regional Development Fund allocating resources to the countries around the Baltic Sea. It involves 13 partners from six countries which are Estonia, Finland, Germany, Latvia, Lithuania and Sweden.

It is our goal that the result of the work which is presented in the report will be useful in the continuing work in the project.

Katarina Ekberg
Activity Leader
Swedish Forest Agency (Skogsstyrelsen)

1 Background

In order to be able to increase the woody bioenergy production in the Baltic Sea Region in a sustainable and cost-effective way an understanding of how the interaction of the bioenergy market and the policy level is very important if not decisive.

Therefore our project began with a mapping of scientific knowledge of policies instruments related to forest bioenergy in the Baltic Sea countries, with a special focus on the harvest and use of logging residues and small trees, which is crucial in order to increase renewable energy from forest. This activity is a basis for the following activities.

1.1 Our Task

To gather the available research and policy related information in the countries around the Baltic Sea with focus on:

- The function of bioenergy markets
- The influence of policy instruments on the current demand
- Scientific knowledge with special focus on the harvest and use of logging residues and small trees

1.2 Method

Swedish Forest Agency prepared a detailed questionnaire for gathering country-specific information on the energy sector. The content of the questionnaire was discussed within the project partnership and all partners had the possibility to adjust and approve the content.

We agreed on that all partners should try to answer as many questions as possible, but if local statistics did not provide all the details we should use the structure which is valid and available. The key idea was to show the role and share of biofuels in the countries around the Baltic Sea. We also said that since there were many questions and some of them were over-lapping each other, it could be a good idea for each partner to start with reading through all the questions before start and decide how the best way to “attack” the questionnaire could be.

The answers should have been ready in beginning of March 2018 but was postponed to beginning of June 2018. The reason was that we should discuss the results on a meeting in Germany which took place at the end of June 2018.

To answer the questions in the questionnaire we made some recommendations:

1. Discuss the issue in your organization and the other sector-specific organizations in your country. Better to promote organizational learning than individual learning!
2. Define the press and mass media in your country to better understand what stakeholders think about the current state of sector-specific issues.

3. Use this available information to fill in the questionnaire. Each partner decides what knowledge is worth of marketing for other countries and partners and what are the most essential knowledge gaps to be filled up.
4. Remember that the result of this activity is a fundament for building "a project house". In the other words, the results of your analysis form contents for the next steps in the work package.

1.3 Expected Output

A report and mapping of relevant documents, articles etc. in the project web-page about:

- Current state-of-art of the bioenergy market in each country
- Policy instruments available at international, national, regional and local levels (use support of project "S2biom": https://s2biom.vito.be/)
- Existing research programs, funding sources and partnerships
  - Technology related research on forest bioenergy
  - Economy related research on forest bioenergy
  - Environment related research on forest bioenergy
- Desirable research programs, funding sources and partnerships
- Environmental aspects to the forest bioenergy
- Issues challenged by the stakeholders (based on the analysis of press releases and mass media articles)
- Further steps

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2 Results

2.1 Total Energy Supply and Use

The first questions were about the total supply and use of energy. The idea was to compare the role of biofuels for the total energy supply and use of energy.

The total use of energy measured in terawatt-hours (TWh) differs of course a lot between the countries due to for example the differences in the population and industry structure. More relevant is to compare the share of biofuel of the total use of energy. Germany has the smallest share of biofuels and Latvia has the biggest.

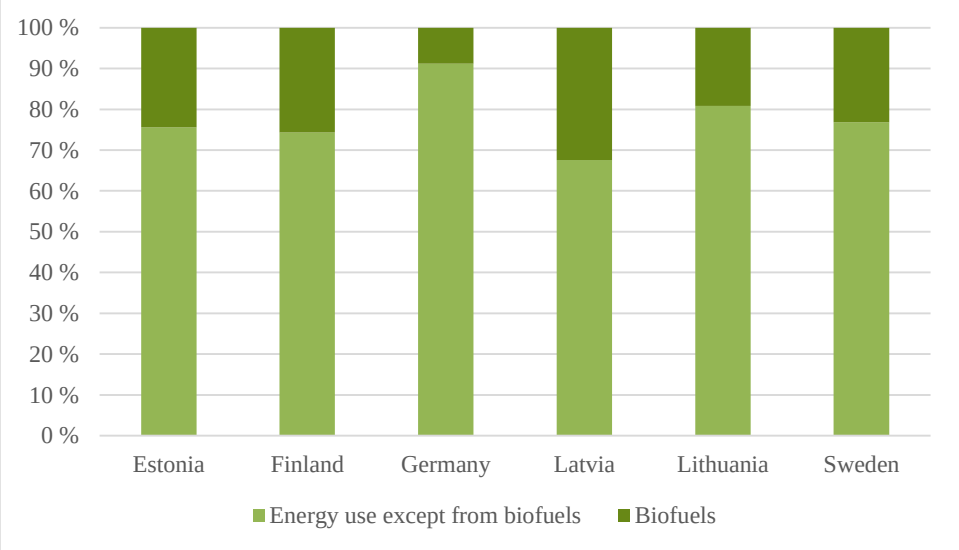

Figure 1. *Share of biofuel and other energy sources of the total use of energy measured in TWh. Year 2016.*

2.2 Total Final Consumption by Sectors

The residential and service sector stands for the biggest share of energy consumption in all countries.

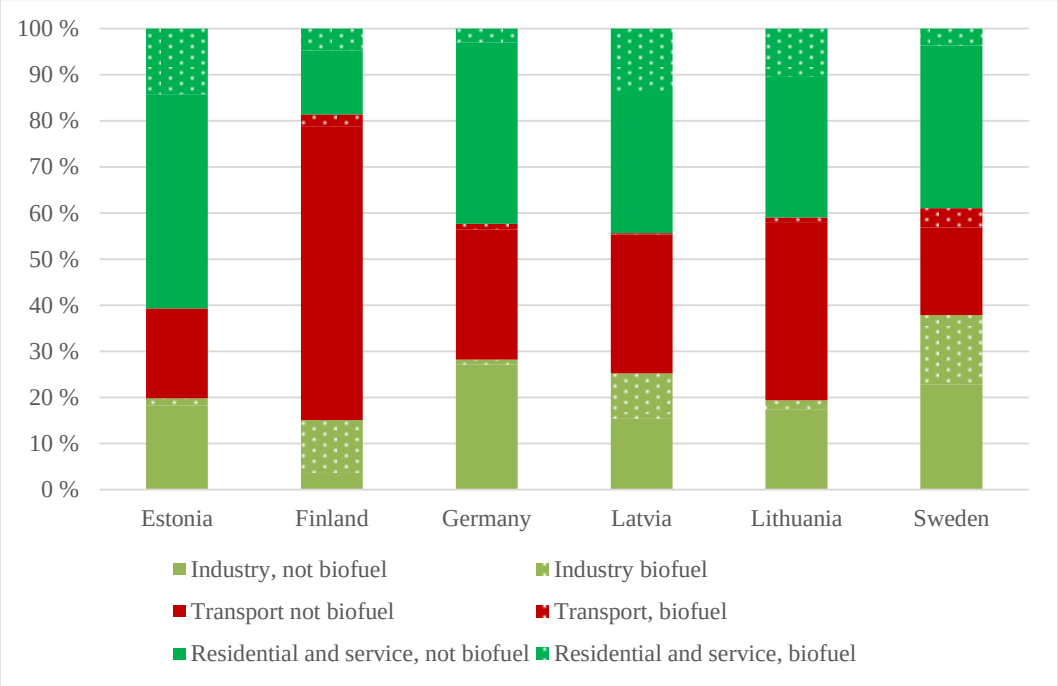

Figure 2. *The share of energy use by sector and within the sector divided in energy from biofuels and not from biofuels. There were no figures on use in the transport sector in Finland, so the diagram is not showing the real proportions.*

2.3 Total Energy Supply and Use from Biofuels

The statistics differs a lot between countries and it is not easy to present some results from the questionnaire. There are difficulties to separate wood from other material in the waste plants production of energy.

We can see that wood fuels are a big share of the biofuel supply and use in the most countries. In Finland and Sweden who has large pulp industries the black liquor also is a very important energy source.

2.4 Supply and Use of Woodfuel

Wood fuels from roundwood as firewood and residues from sawmill production stand for the biggest part in all countries except Germany.

Finland is so far the only country which has a significant production of energy from stumps.

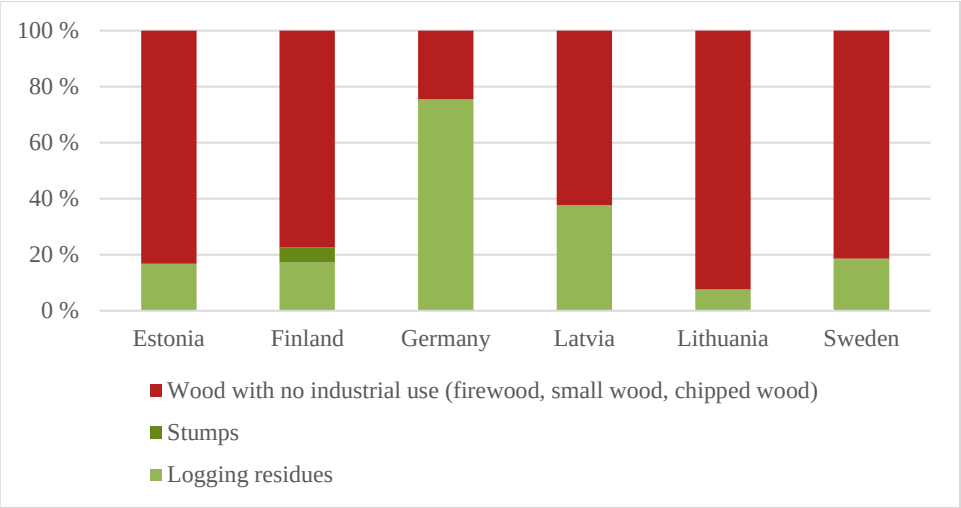

Figure 3.*The use of wood fuels. The figure is based on the use in TWh in all countries except Lithuania where the figures are based on the use in* m^3.

2.5 Price

Discussion related to price and cost levels showed that transportation distances and conditions have an impact on them. Regional variations are also quite common. Therefore it is very difficult to compare prices between countries. More interesting could be to look at the trends, and how different factors affect the price.

2.6 Costs

Just as for the prices there are many differences in how the costs are calculated.

2.7 Policy Instruments

The partner countries have described in the attached detailed answers the importance of the relevant policy instruments related to the forest bioenergy production at the national level. All together 28 questions in the questionnaire were related to the policy instruments, how they influence on the energy supply or use in the specific branch of business.

From Baltic ForBio project point of view the most interesting questions were 4.3, 5.3 (logging residues), 4.7, 5.6 (stumps), 4.11, 5.9 (wood with no industrial use), 4.23 and 5.15 (short-rotation plantations). The project partners used the support of the project “S2biom” (https://s2biom.vito.be/) in order to be able to list all the policy instruments by the partner countries. In the context of Finland, it was listed all together 48 instruments and four of them was assessed to be relevant for forest bioenergy production.

Partner Country	***"S2biom" Project List****	***Forest Bioenergy Relevant Instruments***
Estonia (EST)	20	5
Finland (FIN)	48	5
Germany (GER)	24	6
Latvia (LV)	12	4
Lithuania (LT)	15	6
Sweden (SWE)	14	4

**Internet Search Operator Provided by S2biom Project:https://s2biom.vito.be/*

***Here the number refers to the analysis of the questionnaire mentioned the above chapter from the Baltic ForBio project point of view for logging residues, stumps, wood with no industrial use and short-rotation plantations.*

Table 1. *Policy Instruments by the Partner Countries and the Most Relevant Ones for the Forest Bioenergy Utilization.*

2.8 Scientific Research

Science knowledge section should describe all the research results since 2010 and the earlier ones, if the information is valid nowadays. If the research field cover several of the three areas (economy, technology, environment) it is just mentioned once.

Partner countries listed all together 90 projects related to the forest energy research. The distribution of the research between the thematic emphasizes in technology (32%), economy (38%) and environmental aspects (30%). Quite many research projects implemented concentrated on the stumps harvesting for energy purposes. Young stand treatment as part of energy wood production (wood with no industrial use) was mainly studied in Finland. In Lithuania, there were quite many research studies related to the agricultural waste use for energy generation.

Interesting research topics with the technology emphasize in the partner countries:

1. Technological aspects of wood fuels (EST);
2. Bottlenecks of forest chips supply chains (FIN);
3. Measurement of forest biomass volume and quality (FIN);
4. Sustainable regional supply chains for woody bioenergy (FIN);
5. Quality awareness and competence – better quality for forest chips production based on the training (FIN);
6. Disappearing of energy content in bark and sludge during storaging (FIN);
7. Developing the forest biomass supply systems by rearranging supply operations and logistics (FIN);

8. Reliable and effective wood biomass supply chains from forest to end-users (FIN);
9. Development of an innovative fully mechanized method for pre-commercial thinning – Mini-Harvester (GER);
10. Harvesting methods for young stands emerged by natural regeneration after windbreaks (GER);
11. Harvesting methods for young pine stands – trials in the Lusatian Mining District (GER);
12. Pre-commercial thinning with feller-buncher – test of different harvester heads (GER);
13. Mobilizing and use of energy wood from forests and landscape (GER);
14. Development and assessment of best-practice for harvesting in forests with high value for nature protection (GER);
15. Mechanized harvesting of logs in young and intermediate stands (GER);
16. Piowood – Using fast growing pioneer tree species in forests in order to increase the supply of woody biomass for industrial use and energy production (GER);
17. Methods for planning and quality control of the measures for improvement of forest growth (LV);
18. Approbation of complex forest management service system (LV);
19. Research program on mechanization of forest operations and biofuel (LV);
20. Regional Bioenergy Initiatives – Increasing the market for Biomass use in Europe (LT);
21. Preparation of technology for the production of wood pulp for biofuel and recommendations in forestry (LT);
22. Efficient Forest Fuel Supply Systems 2007-2015 (SWE);
23. Productivity for optimal fuel base (SWE);
24. Measurement of forest fuels (SWE);
25. Cost efficient harvest of forest fuels (SWE);

Interesting research topics with the <u>economy</u> emphasize in the partner countries:

1. Wood fuels and proper raw materials use (EST);
2. Overview of Estonian bioenergy market 2010 (EST);
3. Factors that affect the price of mechanized forest harvesting (EST);
4. Forest chips resources and use (FIN);
5. Estimating the potential of forest chips for energy in Central Finland based on biomass maps and spatially explicit constraints (FIN);
6. Realistic potential for forest biomass supply in EU (FIN);
7. Global forest energy resources, certification of supply and markets for energy technology (FIN);
8. Commercial and energy wood harvesting and wood growing effects in thinning forests (FIN);
9. Birch, aspen and alder as energy wood: growing, harvesting and features (FIN);
10. Development of energy wood markets price statistics (FIN);
11. Assessment methods and availability for biomass resources 2012-2017 (FIN);

12. Impacts of bioenergy policy tools 2012-2017 (FIN);
13. Production, trade services and decision making support methods for energy wood 2012-2016 (FIN);
14. Impacts of artificial drying of forest chips on the profitability of the supply chains 2016-2018 (FIN);
15. Sustainable, climate-neutral and resource-efficient forest based bioeconomy 2015-2020 (FIN);
16. Specification of harvesting information using calculation tools for energy wood assortments and comprehensive mass balances (GER);
17. Optimal supply chains for wood chips (GER);
18. Estimation of the economic benefits of the use of white alder, poplar for biofuel production using various technologies 2016 (LT);
19. Solutions for biomass fuel market barriers and raw material availability 2008 (LT);
20. Needs and opportunities of economic incentives for the use of forest felling waste 2006 (LT);
21. Evaluation of the wood fuel demand and supply and preparation of energy production capacity development based on local wood resources offers 2014 (LT)

Interesting research topics with the <u>environment</u> emphasize in the partner countries:

1. Logging residues and stumps impact to wood organisms (EST);
2. Forestry aspects and environmental impact of collecting Norway spruce stumps (EST);
3. Energy wood harvesting impacts on the features of forest soil, processes and the stand growth 2012-2017 (FIN);
4. Impacts of stumps lifting and harvesting of logging residues on the drainage basin (FIN);
5. Energy wood harvesting impacts on nutrient and heavy metal leaching and adequacy of nutrients in peatland forests (FIN);
6. Impact of stump lifting on the appearance and behaviour of a beetle 2012-2017 (FIN);
7. Appearance of broadleaved tree species and variation in stumps lifting areas (FIN);
8. Young stand treatment and production of biomass in thinnings in young spruce stands (FIN);
9. Impacts of logging residues harvesting in 10 years old spruce stands (FIN);
10. Stumps use for energy generation and the environmental impacts of the harvesting (FIN);
11. Ecological arguments for sustainable use of forest energy and applicability and reliability of the used criteria 2012-2017 (FIN);
12. Bioenergy from forest – tools for minimizing impacts on soil and environment 2016-2017 (FIN);
13. Harvesting of energy wood and sustainability in Germany (GER);
14. Regional restrictions of wood harvesting caused by nature protection (GER);
15. Possibilities and limits of whole-tree harvesting (GER);

16. Process analysis and life cycle assessment of energy wood supply (wood chips) in cooperation with forest owners, harvesting companies, transport companies and heat and power plants (GER);
17. Research program on improvement of forest growth conditions (LV);
18. Value of ecosystems in light of climate change (LV);
19. Performing research on the use of stumps for biofuels: resource, technological, economic and ecological evaluation 2010 (LT);
20. Assessment and recommendations for forest harvesting waste resources and their ecological risk taking from forests 2008 (LT);
21. Baltic Energy Areas – A planning perspective 2016-2019 (LT);
22. Tema Stubbar ”Theme Stumps” (SWE)

2.9 Stakeholder Comments

The project group follow up the discussion in the local mass media what stakeholder groups are commenting on the issues linked with forests as sources of bioenergy generation. The energy decisions are seen as a concrete tool to influence on the national and regional development. Forests are renewable and safe alternative to solve energy generation challenges. Use of locally renewable energy resources reduces the dependence on energy imports. EU is tightening the energy objectives, and therefore biomass is replacing the fossil fuels in the electricity, heat and transportation sectors. How coal can be denied or substituted with biomass is unclear because of the high costs for the conversion process. In densely populated, fireplaces and heaters are considered as the worst sources of soot dust. Logging residues utilization in energy generation is widely accepted, whereas the stumps should be left at the logging sites. It is also under active discussion, whether clear cuttings based forestry has a positive effect on the carbon emissions or not. The last alternative for energy generation is round wood use as energy source. EU is arguing on stump and tall oil utilization in the energy generation.

3 Discussion

The result of the questionnaire shows that it is not easy to compare statistics from each country. The figures are compiled differently and one variable in one country can include something else in another. Therefore it is no use to have the ambition to try to compare the results between countries.

More interesting is to look at the comments about sources, trends and policies.

Some countries as Germany have made a huge work and have taken good help from expert groups. They have used the project for improving their knowledge a lot. Some other countries, like Sweden did not do so much and also did not use the whole activity budget. Depending on the further activities in the project, this gathered basic data in this project activity can be utilized or improved, if appropriate.

Appendix 1 Combination of the Answers

All results from the questionnaire. Partners have gathered the information and commented the numbers, if they have felt it to be appropriate.

Abbreviations: EST = Estonia, FIN = Finland, GER = Germany, LV = Latvia, LT = Lithuania, SWE = Sweden

Total Supply by Energy Carrier

	EST	FIN	GER	LV	LT	SWE
Total energy supplied	69 TWh	378 TWh	3 736 TWh	122 TWh	241 TWh	564 TWh
Of which						
Biofuels	10 TWh 14,9%	97 TWh 25.7%	275 TWh 7,4%	30 TWh 24,5%	98 TWh 40,8%	139 TWh 24,6%
Nuclear power	0 TWh	68 TWh	256 TWh	0,2 TWh	0 TWh	178 TWh
Crude oil, oil products	4 TWh	88 TWh	1 269 TWh	55 TWh	116 TWh	127 TWh
Natural gas, gaswork gas	5 TWh	20 TWh	843 TWh	24 TWh	21 TWh	11 TWh
Coal and coke	0,1 TWh	35 TWh	882 TWh	1 TWh	2 TWh	21 TWh
Hydro power	0 TWh	16 TWh	21 TWh	7 TWh	0,5 TWh	62 TWh
Wind power	0,6 TWh	3 TWh	77 TWh	0,3 TWh	1 TWh	15 TWh
Heat pumps	2 TWh		11 TWh			4 TWh
Others	48 TWh	17 TWh	102 TWh	5 TWh	1 TWh	17 TWh

All figures from 2016.

1.1 Comments on the figures:	
EST	Biofuels in RED definition as biofuel in transportation is not yet in our statistics, here we show biomass fuel (fire wood, wood chips, wood waste, wood briquettes, wood granule, biogas, other biomass)
FIN	Biofuels refer to wood fuel including black liquor and other concentrated liquors, wood fuels used in industry and energy production and small-scale combustion of wood. Peat has its own role in energy generation in Finland being 16 TWh. Heat pumps statistics is included to the group of "Others".
GER	Others includes photovoltaics 38 TWh, waste (renewable) 38 TWh, geothermal energy 3 TWh, solar heat 8 TWh and others 65 TWh. Source: AGEB (2017) Official statistical data, the figures for 2016 are tentative.
LV	At present, it is not possible to precisely separate water and wind energy supply, since the energy produced is fed into the common network, so the table figures are calculated with proportional coefficients. Figures include energy consumption

	used in the energy conversion sector. Currently, statistics on the use of heat pumps are not available in Latvia, but the first data could be available in the second half of 2018.
LT	Others: peat, secondary solid fuel, industrial and municipal waste, solar power. Biofuels included fire wood, wood and agriculture waste, biogas and liquid biofuel. Crude oil and oil products included petroleum products. Source: Energy balance, 2016, Statistics Lithuania.
SWE	Source: Swedish Energy Agency. From the total supply should 11.7 TWh in net export of electricity be excluded.

1.2 What are the trends for biofuel, in terms of TWh, share of total supply of energy and supply?	
EST	Biomass fuels make 15% from supply of energy, bioethanol is used for blending but in so small amounts that not shown in statistics. There are in development from agricultural wastes biomethane plants to use it for public transportation, also in planning bioethanol production from wood.
FIN	The bioenergy is steadily growing because of forest industry investments which increase the wood consumption.
GER	The supply with renewable energies has increased continuously over the last years. The supply of bioenergy is on a high level and has not change significantly since 2010. The share of renewable energies and biofuels of the TPES is rising. Currently the share of biofuels amounts to 7% whereas it was only 3% in the year 2005.
LV	The total amount of energy supply tends to increase, which is largely attributable to the increase in the use and export of biofuels, as well as the growth of export and consumption of petroleum products for transport.
LT	From 2000 to 2016 biomass use in DH sector increased form 2% to ~ 65% - the share of biomass used in DH first time exceeded the share of imported gas. In DH we use almost only wood chips, because local fuel price is much lower than other types of fuels. Lithuania has already reached the targets of the EU Directive regarding the Incentives for Consumption of Renewable Energy Resources for Lithuania to increase this rate to 23 percent until 2020.
SWE	The supply is increasing both in TWh and in share of the total supply and has tripled since 1970.

1.3 Are there national policies, laws, subsidies etc. influencing the supply of energy from biofuels? If there are explain how?	
EST	Electricity production from renewables supported by electricity market act 59 § https://www.riigiteataja.ee/en/eli/528082014005/consolide . Biomethane production pilots got support.
GER	1. Ordinance on the requirements for sustainable production of liquid biomass for electricity production (Biomass Electricity Sustainability Ordinance) (Biomassestrom-Nachhaltigkeitsverordnung – BioSt-NachV) This regulation applies to liquid biofuels which is used to produce electricity according to the Renewable Energy Sources Act (EEG). The regulation defines to produce electricity from liquid biofuels (which is refunded from the EEG) a sustainable production of liquid biofuels. (FNR 2018b) → Increased focus of the sustainability aspect for the energy supply 2. Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz - EEG 2017) "The most important legislative instrument available to promote the generation of electricity from renewable sources is the Renewable Energy Sources Act (EEG). It regulates the supply and remuneration of electricity generated entirely by renewable energy sources through electricity distributor, which operate the common power supply." (FNR 2018p). The last reform of the EEG took place in 2017. "The growing significance of renewable energy sources in the power sector is largely due to the Renewable Energy Sources Act (EEG). Since the adoption of the Renewable Energy Sources Act, the proportion of gross power consumption (total volume of electricity consumed in G) accounted for by renewable energy has risen from roughly 6% in 2000 to 31.7% in 2016 according to preliminary data. By 2025, 40-45 per cent of electricity consumed in G is to derive from renewables." (BMWi 2018b) 3. Ordinance on the production of electricity from biomass (Biomasseverordnung - BiomasseV) The BiomasseV defines the term of biomass within the meaning of the EEG. This includes which material are defined as biomass, for which technical processes for electricity production from biomass does the EEG applies to, which environmental demands need to be observed for electricity production. (FNR 2018) 4. Federal Immission Control Act (Bundes-Immissionsschutzgesetz - BImSchG) The Federal Immission Control Act is put into practice by several ordinances. (FNR 2018) E.g. the 1st BImSchV, the 4th BImSchV and the 13th BImSchV are ordinances for small and medium sized fire installations, for installations requiring a permit and large fire installations regulated the construction and operation of the installations and therefor have an impact on the energy supply. 1st BImSchV (FNR 2018q): "The so-called Small and Medium Size Firing Installations Ordinance (1st BImSchV) determines the fuels permissible for use in boilers and stoves, as well as technical and emission-related requirements and the demands for their supervision by the district chimney sweep. "(FNR 2018q)

	5. Gas Network Access Regulation (Gasnetzzugangsverordnung - GasNZV) The GasNZV regulates the conditions for the access to gas networks for transport customers. (FNR 2018) In addition, it regulates the biogas feed-in and the connection of biogas plants to the gas networks as well as the required gas quality. 6. Gas Grid Charges Ordinance (Gasnetzentgeltverordnung - GasNEV) The GasNEV regulates how gas network operators charge the user fee. 7. Kraft-Wärme-Kopplungsgesetz - KWKG The KWKG is a law for the preservation, modernization and further development of cogeneration. The KWKG regulates the consumption and funding of electricity produced by CHP plants. (FNR 2018) → Increase of electricity production in CHP plants. The regulation is relevant for e.g. operators of CHP plants. 8. Energy Saving Ordinance (Energieeinsparverordnung - EnEV) The EnEV includes regulations for existing and new buildings in order to improve the insulation of buildings and to reduce the amount of energy used. The EnEV should contribute to a reduction of greenhouse gas emissions. (FNR 2018g) → Due to the reduction of energy consumption the EnEV influences the construction of local heating networks because the profitability decreases if the heat consumption decreases. This might influence the decisions to build local biomass plants. Funding opportunities / programmes / subsidies In G there are several funding opportunities for e.g. research institutions and/or companies (e.g. SMEs or large enterprises). Funding programmes (FNR 2018k) and topics addressed are for example: a. Förderprogramm Nachwachsende Rohstoffe: Renewable resources (FNR 2018l) b. Energie- und Klimafonds: Energy efficiency, renewable energies, energy storage technologies, energetic building refurbishment, electromobility (FNR 2018m) c. Gemeinschaftsaufgabe "Verbesserung der Agrarstruktur und des Küstenschutzes “(GAK) d. Marktanreizprogramm, KfW-Programme : Construction and expansion of biomass plants and CHP plants e. Sonderkreditprogramm der Rentenbank: Investments in e.g. biomass CHP plants (FNR 2018m) f. Förderprogramm “Energetische Biomassenutzung “: technologies to produce electricity and heat from biomass (FNR 2018m) g. Förderung von Mini-KWK-Anlagen: new construction of small CHP plants (20 kWel) in existing buildings (FNR 2018m) h. Förderung Kraft-Wärme-Kopplung (KWK): Wärme und Kältenetze: Construction or expansion of heating networks and cooling networks (FNR 2018m) i. Förderung Kraft-Wärme-Kopplung KWK: Wärme- u. Kältespeicher: New construction or modification of heat storage systems and cold storage systems (FNR 2018m)

	The EEG and KWKG offer feed-in remuneration for electricity.
LV	In Latvia, the incentive mechanism for the generation of electricity from renewable energy sources is compulsory purchase of electricity when the public trader is obliged to purchase electricity produced by producers. The granted aid period from the moment of commissioning is set for a period of 10-15 years. From 2012 no new rights to sell electricity produced in the framework of mandatory procurement will be granted the maximum allowable power plant profit margin of 9% was introduced.
LT	There is some support from Lithuania Environmental Investment Fund for biotechnologies in Lithuania - connection fee discount, guaranteed purchase. Electricity is exempted from excise duty on electricity made from renewable energy sources. Preferential transmission of electricity produced from renewable energy sources through electricity transmission or distribution networks. Main laws influencing the supply of energy: Law of Energy, Lithuanian national energy strategy, Renewable energy law and related documents, Heat law etc. There are some subsidies from EU for energy companies, households for boiler modernization, and forest owners for forest management in Lithuania.

Total Final Domestic Use by Energy Carrier

	EST	FIN	GER	LV	LT	SWE
Total energy use	20 TWh	378 TWh	2 542 TWh	51 TWh	42 TWh	375 TWh
Of which						
Biofuels	5 TWh 24,4%	97 TWh 25,7%	224 TWh* 8,8%	17 TWh 32,5%	8 TWh 19,2%	87 TWh 23,2%
Nuclear power	0 TWh	68 TWh	0 TWh	0 TWh	0 TWh	55 TWh
Crude oil, oil products	11 TWh	88 TWh	935 TWh	17 TWh	23 TWh	88 TWh
Natural gas, gaswork gas	2 TWh	20 TWh	643 TWh	13 TWh	7 TWh	6 TWh
Coal and coke	0.21 TWh	35 TWh	131 TWh	0.5 TWh	2 TWh	13 TWh
Hydro power	0.04 TWh	16 TWh	21 TWh	3 TWh	0,5 TWh	56 TWh
Wind power	0.6 TWh	3 TWh	79 TWh	0.1 TWh	1 TWh	14 TWh
Heat pumps	2 TWh	- TWh	113 TWh		0,02 TWh	50 TWh
Others	0.3 TWh	17 TWh	395 TWh	0.8 TWh	0,5 TWh	6 TWh

All figures from 2016.
**51 TWh electricity, 143 TWh heat and cooling and 30 TWh transport*

1.4 Comments on the figures:	
EST	Wood chips are used in CHP as well as in boilers, fire wood is used in local use 2 TWh.
FIN	Total energy consumption has been decreasing trend in Finland during the past years. Combined Heat and Power (CHP) plants have increased the wood use since 2010 (compared to 2009-2016 +43%; compared to 2000-2016 +64%). The share of wind power is 0.8%, but the energy production has increased 10 times compared to 2010. Peat use is decreasing, which is a half of the 2007 level. The oil consumption has decreased slightly -10% after the year 2000. The coal use has changed strongly, but tendency is decreasing. Ministry of Environment stated his view that Finland has to leave the coal use totally in 2025 instead of 2030. This gap will be substituted with biomass including pellets, domestic and imported wood chips, but also with natural gas, which use is nowadays a half of the 2010 level. Especially, the power plants in eastern Finland use imported chips from Russia. Others include recycled fuel, heat pumps and secondary heat energy from industry. Peat is used at the level of 16 TWh.
GER	Sources: AGEB (2017); BMWi (2017b) Comments: • AGEB (2017): - The figures for 2016 are tentative. - Official statistical data - The Total Final Energy Consumption doesn’t include the consumption of energy carriers for other than energy purposes.

	• BMWi (2017b) - Official statistical data - Detailed information about the methodology see Walker et al. (2016). - Bioenergy includes gas from purification plants and dump gas. Others including nuclear power
LV	At present, it is not possible to precisely separate water and wind energy consumption, since the energy produced is fed into the common network, so the table figures are calculated with proportional coefficients. Figures include energy consumption used in the energy conversion sector. Currently, statistics on the use of heat pumps are not available in Latvia, but the first data could be available in the second half of 2018.
LT	There is lack of knowledge how many energies made by industrial and municipal waste is used. Biofuels included fire wood, wood and agriculture waste, biogas and liquid biofuel. Crude oil and oil products included petroleum products. There is lack of knowledge how many energies made by crude oil is used. Others: peat, secondary solid fuel, industrial and municipal waste, solar power. Source: Energy balance, 2016, Statistics L.
SWE	Source: Energimyndigheten/Swedish Energy Agency

1.5 What are the trends for biofuel, in terms of TWh, share of total use of energy and supply?	
EST	Biomass fuel makes 1/4 of final use of energy. Based on sustainable use of wood set in forestry development plan and energy management development plan we could use energy wood up to 18 TWh (10.9 TWh of that was used or exported in 2016).
GER	The use of bioenergy is continuously rising. - 2000: 62 TWh is consumed (Brutto Electricity production + Final Energy Use for heat and cooling +Final Energy use in the transport sector, incl. energy from gas from purification plants and dump gas) - 2006: 157 TWh - 2016: 224 TWh. The share of bioenergy for electricity and for heat and cooling is increasing. The share of bioenergy in the transport sector is decreasing after a peak in 2006/2007.
LV	In recent years, changes in the total consumption of energy resources have been observed, with the share of natural gas consumption decreasing, the share of renewable energy (RES) in total energy resources is increasing. Over the decade, the share of natural gas consumption decreased by 4.2 percentage points and in the year 2016 it was 25.4%, while the proportion of wood fuel consumption increased by 4.4 percentage points and in 2016 it was 29.4%. In 2016, compared to 2015, the amount of wood chips produced increased by 18.8%, as a result of which the consumption of wood chips in the transformation sector increased by 23.7%. Latvia has the third highest share of RES in final energy use in the European Union (EU), in 2015 it was 37.6%.

LT	Total use of biofuel is increasing - from 1,419.8 thousand tonnes of oil equivalent (2015) to 1,461.2 thousand tonnes of oil equivalent (2016).
SWE	The use is increasing both in TWh and in share of total use. Nuclear power though is the main source for production of electricity. Biofuel stands for around 6% of the electricity production and is expected to be the same the following years from now.

1.6 Are there national policies, laws, subsidies etc. influencing the use of energy from biofuels? If there are explain how?	
EST	Fossil fuels excise makes use of fossil fuels more expensive than biomass fuels. Bio methanol potential is 4.7 TWh which is planned with bio methanol action plan, in 2021 every gas sellers should sell 4% bio methanol (in total 20 million m^3). To fulfil it 28 million € support has made available for bio methanol projects and around 5-6 producers are expected to start production, including En Cells who is using aspen pulpwood.
GER	1. Renewable Energy Heat Act (EEWärmeG) This amendment "states that owners of new buildings must use energy from renewable sources to cover a portion of their heating and cooling requirements (use obligation). The use of solar thermal systems, biomass (solid, liquid or gas) and geothermal energy/environmental heat is permitted. "The owner of the building is free to decide which form of renewable energy to use." (IEA 2013) The EEWärmeG should contribute to increase the portion of renewable energies in the final energy consumption for heating and cooling to 14% by 2020. (FNR 2018d) 2. Energy Saving Ordinance (Energieeinsparverordnung - EnEV) The EnEV includes regulations for existing and new buildings in order to improve the insulation of buildings and to reduce the amount of energy used. The EnEV should contribute to a reduction of greenhouse gas emissions. (FNR 2018g) → Leads to a reduction of energy consumption The funding opportunities/subsidies mentioned in question 1.3 have as well as impact on the use of energy from biofuels.
LV	The financing of EU projects facilitates energy efficiency and the use of local renewable energy sources in district heating. The aid is granted in the form of grants of 40% of the project investment - reconstruction and construction of a heat supply and transmission and distribution system, including the purchase of technological equipment and installation.
LT	There is investment support from Ministry of Economy for installation of biomass boilers in Lithuania. In 2016, Lithuania decided to require all regulated heat providers to buy all biomass via BALTPOOL (Lithuania energy exchange) - regulated companies trade 88% of their biomass over the exchange, although third of the 74 registered buyers are not regulated. This unique energy exchange influenced lower prices and easier market. The Biomass Exchange is an online trading venue operating according to the set rules and providing buyers and sellers

	with an opportunity to finalise contracts electronically in the Biomass Product Exchange. The Biomass Exchange operates as the central venue in which market participants-sellers (suppliers of biomass) and buyers (normally heat production companies) - meet anonymously.
SWE	Since 1990's there are taxes on emission of CO_2 in Sweden. Biofuel are not included which is one explanation of the increased use of biofuel. The electricity certificate market from 2003 and the emissions trading since 2005 have also promoted the use of biofuels. Biofuels stands for 63% of the energy production in district heating systems.

Total use by sector

Industry sector

	EST	FIN	GER	LV	LT	SWE
Industry, total	6 TWh	12 TWh	717 TWh	12 TWh	11 TWh	142 TWh
Of which						
Biofuels, waste etc	0.5 TWh 8,0 %	9 TWh 76%	27 TWh* 3.8%	4.5 TWh 39%	1.1 TWh 9.7%	56.3 TWh 39.6%
Electricity	2		226	2	3	49
District heating	2		48	0.8	2	4
Oil products	0.6	0.1	17	2.7	0,3	9
Natural gas, gaswork gas	0.6	1	473**	1.4	3	4
Coal and coke	0.2	0.3	122	0.2	0.9	13
Others (incl.peat)	0.1	0.8		0.01	0.14	6

**Solid biofuels*
***incl. natural gas and natural oil gas*
All figures from 2016.

2.1 Comments on the figures:	
EST	2.1 Half of boilers heat in industry used wood fuels making 0.7 TWh and 1/3 total heat (incl. CHP) used by industry in 2016.
FIN	Source: Energiateollisuus ry (Finnish Energy Industry Association): Waste 0.53 TWh also should be added as one used fuel type. General comment: Energy plants use coal in the sea coast because of its price competitiveness and inland energy

	plants use peat and partly wood chips.
GER	Source: AGEB (2017) Comments: • AGEB (2017): - Official statistical data - The figures for 2016 are tentative. • BMWi 2017b: - Official statistical data
LV	Excludes energy consumption used in energy conversion sector.
LT	Others: peat, secondary solid fuel. Biofuels included fire wood, wood and agriculture waste, biogas and liquid biofuel. There is no info about final domestic use of energy made by industrial and municipal waste, hydropower, wind and solar power. Oil products mean petroleum products. Source: Energy balance, 2016, Statistics Lithuania.
SWE	The Swedish Energy Agency

2.2 What are the trends for biofuel in the industry sector in terms of TWh, share of total use of energy and demand?	
EST	2010-2016 use of wood fuels in industry boilers has been between 0.7-0.9 TWh. In 2014 there was 403 boilers on wood and 374 boilers on wood in industry in 2016.
FIN	In the large scale, the investments have been implemented. When the current energy plants reach their technical operation age, the new investments will realize moving to renewables e.g. Naantali (Turku) December 2017 started power plant.
GER	In the years 2000 – 2004, the biofuels for heat and cooling increased significantly in the industry. Since 2010 it is stagnating on a high level.
LV	Total energy consumption in the manufacturing sector over the last 5 years is relatively stable. Consumption of biomass and heat has a slight tendency to increase, while consumption of coal and natural gas is significantly reduced. The share of total energy consumption in the manufacturing sector is relatively unchanged.
LT	The use of biofuels in the industry sector in terms of TWh increased from 0.9 TWh in 2011(8% of total industry sector use) to 1.1 TWh in 2016 (9.7 % of total industry sector use).
SWE	Although production in industry has increased, so has the use of energy has been relatively constant since the 1970's. Biofuel has almost doubled since 1970's. Depends above all on the transition from oil in the pulp and paper industry. The pulp and paper industry accounts for 90% of biofuel use in the industry. Common fuel is black liquor and wood fuel.

2.3 Are there national policies (laws, subsidies etc.) influencing the use of energy from biofuels in the industry sector? If there are, explain how?	
EST	Industries with CHP on wood can sell electricity and have got renewables support based on power market act. New capacities will be supported based on cheapest offer. Fossil fuels excise.
GER	See document "Answers to the Questions of sheet 1-3 in the questionnaire related to national policies".
LV	Excise duty does not apply to natural gas used by the end user for purposes other than fuel or heating material. The reduced excise tax rate is applied to natural gas and oil products in order to provide a technologically necessary climate for industrial production and primary processing of agricultural raw materials.
LT	Industry sector using energy made by of renewable energy sources, pays lower environmental pollution taxes.
SWE	European Parliament and Council Directive 2015/2193/EU of 25 November 2015 on the limitation of emissions of certain pollutants into the air from large combustion plants. Energy tax and carbon tax, law (1994:1776) if the tax on energy and Law (2009:1497) amending the Act (1994:1776), if the tax on energy. Energy intensive industries such as steel and metal works, oil refineries do not pay a carbon tax, instead they have to buy emissions rights corresponding to the emission of CO_2.

2.4 What other factors influence the use of biofuel in the industry sector?	
EST	New and smart technologies, heat pumps, resource and energy efficiency auditing, warmer weather, prices of oil and wood and other commodities.
FIN	RED II Directive will steer the process. No restrictions for stem wood, pine oil and stumps utilization for energy production purposes. Weather conditions and fluctuation in the economic tendencies have an impact on the use of biofuel in the industry sector.
GER	See document "Answers to the Questions of sheet 1-3 in the questionnaire related to national policies".
LV	Due to the wide availability of wood chips in Latvia and the improvement of heating technologies, the use of chips in industrial facilities becomes one of the most important energy sources, especially, where there is no natural gas connection. In 2018, a support program for the manufacturing industry will be launched, which will partially finance the purchase of renewable energy sources of heat, cold and electricity production.
LT	Official policy of the state to diversify energy carriers and reduce the share of energy (gas especially) imported from Russia.

Transport sector

	EST	FIN	GER	LV	LT	SWE
Transport, total	6	51	749	14	23	87
Of which						
Biofuels for transport	0	2	30	0.1	0.7	16
Oil products	3		706	14	22	68
Electricity	0.05		11	0.1	0.01	3
Others	0.1		4	0	0.4	2

All figures are from 2016.

2.5 Comments on the figures:	
EST	Bioethanol blending and biomethane use is not considerable and not yet in statistics.
FIN	Source: Energiateollisuus ry (Finnish Energy Industry Association): Waste 0.5 TWh also should be added as one used fuel type. General comment: Energy plants use coal in the sea coast because of its price competitiveness and inland energy plants use peat and partly wood chips.
GER	Sources: • AGEB (2017) Comments: • AGEB (2017): - Official statistical data - The figures for 2016 are tentative.
LV	Excludes energy consumption used in energy conversion sector.
LT	Others included natural gas. Source: Energy balance, 2016, Statistics Lithuania.
SWE	The Swedish Energy Agency

2.6 What are the trends for biofuel in the transport sector in terms of TWh, share of total use of energy and demand?	
GER	See separate document.
FIN	The field-level actors follow the national and EU-level target settings for the biofuels in the transport and traffic sector.
LV	The total energy consumption in the transport sector tends to increase by about 2% per year. Major consumption fluctuations are observed for biofuels. The increase in energy consumption is mainly due to the increase in the number of cars and freight. The share of energy used for transport tends to increase, due to the decrease in consumption of other sectors.
LT	The total share of biofuels in the transport sector in terms of TWh increased from 0.5 TWh in 2011 to 0.7 TWh in 2016 along with increment of total consumption of all sorts of transport fuel. Therefore, total biofuels use in transport sector decreased from 2.9% in 2011 to 2.8% in 2016.
SWE	The use of biofuel in transport sector is increasing. The main fuels are bioethanol, biodiesel (FAME and HVO) and biogas. ***Ethanol:*** All 95-octane petrol consists of a small part 5% of bioethanol. E85 and ED95 are mainly made of bioethanol. The use of ethanol has decreased during the last five years partly because the total use of petrol has decreased. ***Biodiesel:*** Biodiesel is the most common biofuel and the use is increasing. The sales of diesel cars and trucks and the traffic in increasing. Biodiesel is both included in fossil diesel and used as pure biodiesel. ***Biogas:*** The use of biogas is increasing. 87% of the gas used in vehicles is biogas. There is a goal to reach 100%. Especially bus companies driving for municipalities are demanding 100% renewable fuel.

2.7 Are there national policies (laws, subsidies etc.) influencing the use of energy from biofuels in the transport sector? If there are, explain how?	
EST	Biomethane action plan and support for production, network and usage in public transportation, more information https://www.kik.ee/en/supported-activity/production-biomethane-and-promoting-its-use-transportation
FIN	Finland has doubled the target level compared to the other EU28-countries.
GER	See document “Answers to the Questions of sheet 1-3 in the questionnaire related to national policies”.

LV	From 1 October 2009, Latvia introduced a mandatory 5% biofuel blend for fossil fuels, except for arctic diesel, aviation fuel and 98th grade petrol. Since 2006, reduced rates of excise duty on clean biofuels and biofuel and fossil fuel mixes with high biofuel content have been introduced.
LT	The state compensates biofuel producers for the cost of purchasing raw materials.
SWE	All fuel with a small amount of ethanol can get the tax credit. According to European Parliament and Council Directive 98/70/EC provides for a ceiling on an incorporation rate of 10% ethanol. The big question for ethanol is, what will be decided at EU level regarding biofuel production based on crop on the subject in the form of the new renewables directive (also called REDII) hopefully in 2018. The 1st of July 2018 introduced the reduction obligation for fuel suppliers of petrol and diesel in Sweden. The reduction obligation means that fuel suppliers must achieve emission reductions and thus blend in more biofuels. The year 2020, it is expected the involvement of ethanol to be about 8% and for biodiesel 22%. In Sweden, there is a consumption aid in the form of exemptions from the energy and CO_2 tax for biogas. In the budget bill for the Government intends to analyse 2018 described market conditions for Swedish biogas and propose long-term controls. In e.g. Denmark has a grant to produce biogas. CORSIA – Carbon Offsetting and Reduction Scheme for International Aviation: The decision means that CO_2 emissions from international flights shall be stabilized at 2020, which begins in 2021 on the voluntary basis and from 2027 it will became mandatory. If the company not succeed they will be forced to by emissions trading. Reduction of duty leads to increased use of small amount of biodiesel in all diesel from 2018. The new aviation tax is expected to affect so that flying rising more slowly than it would have without the tax. “Bonus-malus” means that new cars with low emissions will receive a bonus, funded by a height tax from new cars with high emissions.

2.8 What other factors influence the use of biofuel in the transport sector?	
EST	Oil price, development and price of electric and self-driving cars
FIN	Price and availability for the biofuels.
GER	See document “Answers to the Questions of sheet 1-3 in the questionnaire related to national policies”.
LV	In Latvia, there are very few biofuels available, as, for example, E85 fuel is marketed at four petrol stations. Neste Latvia offers Neste Pro Diesel based on 15% hydrogenated vegetable oil (HVO), which is produced by hydrogenating various products from plants and animals - palm oil, animal and fish oil residues, rapeseed and soya oil, algae, germs and other raw materials. The product can be purchased at 36 Neste filling stations.
LT	There is compulsory mixing of biofuels in mineral fuels in Lithuania.

SWE	Sweden's cold climate also plays a role in this as less ethanol blended in during the cold months. Particulate matter emissions affecting air quality, and this is a problem mainly in urban environments. Therefore, there has been some discussion in recent times to introduce environmental zones in urban environments that put a cap on how much particulate emissions vehicles driving in these zones may generate. When and if these environmental zones introduced diesel, cars can come to lose ground to other fuels. Particulate filter helps some but not down to the petrol level. Access to HVO to achieve the reduction levels may be inadequate. Pure biodiesel is not included in the reduction obligation, so you may pull down on it to clear involvement in the fossil diesel. A large part of the HVO is made from palm oil which may be prohibited by the European Parliament. Customs duties on imports from countries outside the EU. Eventual airport tax increased use of aviation fuel. https://ssl.microsofttranslator.com/static/25463966/img/tooltip_logo.gifhttps://ssl.microsofttranslator.com/static/25463966/img/tooltip_close.gif

Residential and service sectors

	EST	FIN	GER	LV	LT	SWE
Residential and service sectors, total	20	14	1 076	20	24	146
Of which						
Biofuels,waste etc	5	4	77*	6	6	14
Oil products	3	0.04	212	1	0.6	11
Electricity	2		278	5	6	73
District heating	6		65	6	7	46
Natural gas, gaswork gas	1	3	390	2	2	2
Coal and coke	0.02	5	9	0.2	0.8	0
Others (incl peat)	0.0005	2	45	0	0.3	0

**solid*
All figures from 2016.

2.9 Comments on the figures:	
EST	From biomass fuels 3.1 TWh fire wood was used for local heating.
FIN	Source: Energiateollisuus ry (Finnish Energy Industry Association): Waste 0.44 TWh also should be added as one used fuel type.
GER	Sources: • AGEB (2017) • BMWi 2017b Comments: • AGEB (2017): - Official statistical data - The figures for 2016 are tentative. • BMWi 2017b: - Official statistical data - Solid biofuels are one of the bioenergy sources used in the industry.
LV	Excludes energy consumption used in energy conversion sector.
LT	Others: peat, secondary solid fuel. Biofuels included fire wood, wood and agriculture waste, biogas and liquid biofuel. Oil products mean petroleum products. Source: Energy balance, 2016, Statistics Lithuania.
SWE	Source: The Swedish Energy Agency. 10.4 TWh of the total 14 TWh biofuels, waste etc. is used in small family houses. Consists of 6.5 million m^3 firewood, 0.5 million m^3 wood chips and 456 tons pellets.

2.10 What are the trends for biofuel in the residential and service sector in terms of TWh, share of total use of energy and demand?	
EST	1991-2015 there were installed about 120,000 heat pumps with total capacity 735 MW. Heat pumps in local heating will have impact for use of fire wood in longer run.
FIN	The use of forest chips and pellets is increasing in the heat energy generation.
GER	See separate document.
LV	The energy consumption in the household and services sector tends to decrease, which is mainly due to the decrease of the population in Latvia. The most significant decrease is for natural gas and coal. Relatively stable consumption is for electricity. The share of households and services in the total energy consumption is gradually decreasing.

LT	The use of biofuels in the residential and service sector in terms of TWh decreased from 7 TWh in 2011 to 6 TWh in 2016. Big part of residential sector use biofuel for heating. In the heat energy balance of individually heated households in 2015 renewable energy resources accounted for 70%.
SWE	Energy use reduction 2000-2009, but grew thereafter, but is now back to the level before 2010. Especially cold weather contributed to the increase. Supplied energy for heating and hot water is reducing. Oil is replaced by electricity or district heating. Number of heat pumps is increasing. Oil products have decreased by 90% since 1970. Biofuel is mainly used in single-family houses and for heating and hot water. The majority (60%) of the fuel to the district heating production consists of biofuels. About 30% is waste.

2.11 Are there national policies (laws, subsidies etc.) influencing the use of energy from biofuels in the industry sector? If there are, explain how?	
EST	Support to increase living houses energy efficiency, see more http://www.kredex.ee/en/grant/
GER	See document “Answers to the Questions of sheet 1-3 in the questionnaire related to national policies”.
LV	At present, active support is intended to increase the energy efficiency of multi-apartment buildings, energy certification of buildings and increase energy efficiency, use of renewable energy sources (RES) in buildings, when very high energy efficiency indicators are achieved, and the installation of RES facilities along with energy efficiency measures is economically feasible.
SWE	Green tax shift that imposes higher taxes on electricity and fossil fuels is positive for biofuel use. Directive on the energy performance of buildings. The latest 2020, all new buildings should be "close-to-zero-energy-buildings". See Planning and building regulation. In 2017, there were 778 million earmarked for support to the renovation and energy efficiency for rental units. Investment aid for the installation of solar cells since 2009.

2.12 What other factors influence the use of biofuel in the residential and service sector?	
EST	Heat pumps, smart meters and smart house solutions, change in standards and requirements for wood ovens and fireplaces, development of district heating and cooling.
FIN	Weather conditions and the fuel prices of competing energy sources have an influence on the use of biofuels in the residential and service sector.
GER	See document “Answers to the Questions of sheet 1-3 in the questionnaire related to national policies”.

LV	In the form of national project invitations, several times, it has announced support for a 50% refund if heat pumps or other renewable technologies are installed as a home heating source. This has led to the modernization of household heating systems and the transition to renewable energy resources.
SWE	About 50% of energy use goes to heating and hot water, large influence of outside temperature. Previously, electricity prices are high and many switched to heat pump, district heating and pellets so recently, electric heating use remained fairly constant. We get more energy-efficient appliances, but we are using more and more making the household electricity is not reduced.

Total energy supplied from biofuels including import

	EST	FIN	GER*	LV	LT	SWE
Total Energy supplied from Biofuel (TWh)	10	98	275	30	15	139
Of which						
Wood Fuel	8	55	36	24	14	63
Recovered Paper	0	2	0	0	0	0
Spent liquor (Pulp Industry)	0	41	96**	0	0	47
Others, refused/waste etc.	2	0	142	1	1	29

** = the statistics of the year 2014*
*** = biogenic residues from forest industry*

3.1 Comments on the figures:	
EST	Wood fuel = firewood, wood chips, briquettes and granule. There is no statistics of recovered paper and spent liquor used for energetic purposes.
GER	Use of paper for energy production 53,000 tons. Supply of black liquor in 2010 was 3.6 Mio m^3 Sources: • AGEB (2017) • Mantau (2012) • Destatis (2017) Table „Abfallbilanz 2015“ Comments: • AGEB (2017): - Official statistical data - The figures for 2016 are tentative.

	- Total Primary Energy Supply (TPES) based on biofuels import and export are not included. • Mantau (2012): - Black liquor: Mantau (2012) no further explanation of method for data mining; the mentioned source Weimar (2008) is not available online • Destatis (2017) Table „Abfallbilanz 2015“ - Official statistical data Sources: • AGEB (2017) • Mantau (2012) • Destatis (2017) Table „Abfallbilanz 2015“ Comments: • AGEB (2017): - Official statistical data - The figures for 2016 are tentative. - Total Primary Energy Supply (TPES) based on biofuels: import and export are not included. • Mantau (2012): - Black liquor: Mantau (2012) no further explanation of method for data mining; the mentioned source Weimar (2008) is not available online. • Destatis (2017) Table „Abfallbilanz 2015“ - Official statistical data Sources: • AGEB (2017) • Mantau (2012) • Destatis (2017) Table „Abfallbilanz 2015“ Comments: • AGEB (2017): - Official statistical data - The figures for 2016 are tentative. - Total Primary Energy Supply (TPES) based on biofuels: import and export are not included. • Mantau (2012): - Black liquor: Mantau (2012) no further explanation of method for data mining; the mentioned source Weimar (2008) is not available online. • Destatis (2017) Table „Abfallbilanz 2015“ - Official statistical data
LV	Source: Forest and Wood Products Research and Development Institute (abbreviated as MeKA) Source of Others. refused/waste etc, information from Latvian Energy balance in 2016 http://data.csb.gov.lv/pxweb/lv/vide/vide__ikgad__energetika/EN0020.px/table/tableViewLayout2/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0
LT	Others included agricultural, industrial, municipal waste, landfill, sludge and other biogas. Source: Energy balance, 2016, Statistics Lithuania.

3.2 What are the trends for recovered paper, in terms of TWh, share of total supply of energy and supply?	
FIN	Recovered paper is utilized primarily in the paper production, not for energy generation.
GER	The supply of used paper is constant. The recycling rate is 99%. The use of used paper for energy production is very low (<1%).
LV	No statistical data about recovered paper usage in biofuel supply.
LT	There is no information on the production of energy from recycled paper.

3.3 Are there national policies, laws, subsidies etc. influencing the supply of energy from recovered paper? If there are, explain how?	
GER	See document "Answers to the Questions of sheet 1-3 in the questionnaire related to national policies".
LV	No policies supporting supply of biofuel from recovered paper exist.

3.4 What are the trends for spent liquor, in terms of TWh, share of total supply of energy?	
FIN	The share of spent liquor is increasing in the total energy supply, because it is strongly dependent on the pulp production volumes.
GER	The supply of black liquor directly depends on the production capacities in the paper industry. In 2004/2005 a significant increase can be observed (Mantau 2012, S. 53). Since then it is constant, and no further increase can be expected (BMWi 2015). The total supply of black liquor was 3.6 Mio. m^3 in the year 2010 (Mantau 2012, S. 15). Nearly all of it has been used for energy production in the paper industry (Mantau 2012, S. 53; BMWi 2015a, Weimar, Döring & Mantau 2012).
LV	This product is not produced in Latvia.
LT	There is no information on the production of energy from spent liquor.

3.5 Are there national policies, laws, subsidies etc. influencing the supply of energy from spent liquor? If there are, explain how?	
GER	See document "Answers to the Questions of sheet 1-3 in the questionnaire related to national policies".
LV	No such policies exist.

3.6 What are the trends for others, refused/waste in terms of TWh, share of total supply of energy and supply?	
FIN	The biggest energy efficiency investments have been already implemented.
GER	See document "Answers to the Questions of sheet 1-3 in the questionnaire related to national policies".
LV	No statistical data about refused/waste usage in biofuel supply as a solid biofuel. Incineration of household waste does not separate plastics and wood. Comprehensive statistics exists on production of biogas.
LT	The first waste plant in Lithuania was opened in 2013. Industrial and municipal waste use in energy production increased from 0.3 TWh in 2014 to 0.5 TWh in 2016. Currently two more waste plants are under construction.

3.7 Are there national policies, laws, subsidies etc. influencing the supply of energy from others, refused/waste? If there are, explain how?	
GER	See document "Answers to the Questions of sheet 1-3 in the questionnaire related to national policies".
LV	Regulations on waste management support production of biogas from biomass, including household waste. Considerable investments are provided by Rural development programme to develop new biogas facilities.

Total domestic energy use from biofuels

	EST	FIN	GER	LV	LT	SWE
Total Energy supplied from Biofuel (TWh)	5	98	275	17	8	139
Of which						
Wood Fuel	3	55	36	14	7	63
Recovered Paper	0	2	0	0	0	0
Spent liquor (Pulp Industry)	0	41	96	0	0	47
Others, refused/waste etc.	2	0	142	1	1	29

3.8 Comments on the figures:	
EST	There is no statistics of recovered paper and spent liquor used for energy purposes.
FIN	Deinked pulp is burnt for energy, if it is not suitable for paper production (zero fibre content).
LV	Source: Forest and Wood Products Research and Development Institute (abbreviated as MeKA)
LT	Others included agricultural, industrial, municipal waste, landfill, sludge and other biogas. Source: Energy balance, 2016, Statistics Lithuania.
SWE	Recovered paper is mostly not used for energy purpose and is not relevant. The biofuel use is distributed on following: 39% wood fuel 6% processed wood fuel 33% bred black liquor from wood fuel 8% biodiesel 2% pine and oil 8% biogenic household waste 4% other biofuels (Peat is included in all other fossil fuels combined with waste. It is coated with a sulphur tax. It is defined as the fossil fuel in emissions trading.)

3.9 What are the trends for recovered paper, in terms of TWh, share of total use of energy and how it is used?	
FIN	There are no actions for gathering recovered paper for energy generation purposes.
LV	No statistical data about recovered paper usage in biofuel supply. Only private usage.
LT	There is no information on the production of energy from recycled paper.

3.10 Are there national policies, laws, subsidies etc. influencing the use of energy from recovered paper? If there are, explain how?	
LV	No such policies exist.

3.11 What are the trends for spent liquor, in terms of TWh, share of total use of energy? Include also trends for using spent liquor for production of diesel.	
FIN	The volume depends strongly on the pulp production market situation. When the pulp production increases, it provides more spent liquor for energy generation.

LV	This product is not produced in Latvia.
LT	There is no information on the production of energy from spent liquor.

3.12 Are there national policies, laws, subsidies etc. influencing the use of energy from spent liquor? If there are explain how?	
LV	No such policies exist.

3.13 What are the trends for others, refused/waste in terms of TWh, share of total use of energy?	
LV	No statistical data about refused/waste usage in biofuel supply, except comprehensive statistics on use of biogas, however, heat and electricity production from biogas can't be easily separated.
LT	In 2013 were used 0.3 TWh energy made from waste. In 2016 amount increased till 0.4 TWh.

3.14 Are there national policies, laws, subsidies etc. influencing the use of energy from others, refused/waste? If there are, explain how?	
LV	No support exists for use of energy produced from waste materials; it is supported through production related payments for electricity production.

Total energy supplied (including import and export)

	EST	FIN	GER	LV	LT	SWE
Forest fuel	13 TWh 6.2 mln m^3	37 TWh 19 mln m^3	64 mln m^3	24 TWh 9.5 mln m^3	14 TWh 8.4 mln m^3	56 TWh
Of which						
Logging residues	1.4 TWh 0.72 mln m^3	4.8 TWh 2.5 mln m^3	9.4 mln m^3	5.5 TWh 2.4 mln m^3	0.91 TWh 457,000 m^3	10 TWh
Stumps	0.3 TWh 0.15 mln m^3	1.5 TWh 0.76 mln m^3				0.16 TWh
Wood with no industrial use		9.4 TWh 4.9 mln m^3				
Firewood	5.7 TWh 0.29 mln m^3			6.6 TWh 3.3 mln m^3	3.7 TWh 2.2 mln m^3	9.6 TWh
Small wood				0.44 TWh 179,000 m^3	4.8 TWh 2.4 mln m^3	
Chipped wood	N/A			1.2 TWh 597,000 m^3	2.8 TWh 1.4 mln m^3	5.8 TWh
Industrial residues	4.5 TWh 2.2 mln m^3	21.1 TWh 11.0 mln m^3	14.0 mln m^3	3.3 TWh 1.7 mln m^3	2.8 TWh 1.4 mln m^3	21.5 TWh
Sawdust					0.48 TWh 280,000 m^3	
Industrial bark					0.98 TWh 380,000 m^3	
Processed wood fuels (pellets)	5.3 TWh 2.7 mln m^3	0.4 TWh 0.19 mln m^3		7.3 TWh 1.6 mln tons		8.4 TWh
Wood from non-forest land	1.2 TWh 0.6 mln m^3	N/A				
Short-rotation	N/A	N/A	88,000 tons		0.49 TWh 224,000 m^3	0.1 TWh
Recycled wood-fuel	0.1 TWh 0.69 mln m^3	1.7 TWh 0.89 mln m^3	7.7 mln tons			4.8 TWh

4.1 Comments on the figures:	
EST	There is no statistics asked, but estimation of forest fuel potential and prognosis: https://docs.google.com/spreadsheets/d/10zsvX5VKMcKZbm4mKJrdktJYPbJNK3Zihq1g_7XHwS8/edit#gid=2
FIN	There is no big difference in Finland between the supply and the use of wood fuels, because the import and export of energy sources is low. Please, look the figures at the next page of the questionnaire.

GER	Official statistics: - timber and energy wood from forests, imports (Weimar 2016; Bundesministerium für Ernährung and Landwirtschaft (BMEL) 2017) - arable land used to produce solid biofuels Surveys: - residues from sawmills (Döring et al. 2017) (Döring & Mantau 2012) - recycled wood (Döring et al. 2018a) , (Mantau 2012) Estimation based on production capacities: other industrial residues (Mantau 2012) WEHAM-scenarios: Modelling of future available forest biomass in scenarios (3 forest management scenarios, 3 market scenarios) All sources are used by the German government as information source. There are no statistics available on the production of biofuel from short rotation. However, there is official information on the area on which energy crops are produced (11,000 hectares (Fachagentur Nachwachsende Rohstoffe e. V. (FNR) 2018)). Experts estimate, that 20% are used to produce miscanthus. Hence, there remains a maximum of 8,800 hectares for short rotation coppices. With an estimated yield of 10 tons dry matter per hectare and year, the wood fuel production from short rotation amounts to 88,000 tons dry matter per year (maximum).
LV	Source: Forest and Wood Products Research and Development Institute (abbreviated as MeKA) and information from Latvian Energy balance in 2016. Statistical information about stump usage in supply of wood fuel - collection of expert judgement; information about small trees from National forest inventory data on extracted trees in young stands.
LT	Statistics Lithuania, Baltpool, Energy exchange, 2018, Directorate General of State Forests, 2018, Lithuania State Forest Service, The Lithuania Academy of Sciences.
SWE	There are also 397 GWh in residues from parks and gardens. 975 GWh of chips of "parts of trees from pre-commercial thinning" are included in logging residues (Grot).

4.2 What are the trends for logging residues in terms of TWh, share of total supply of energy and supply?	
EST	2015 logging residues made 5% from cutting volume 10.4 million m^3. From woody biomass from forest, non-forest land and industry (13.1 TWh) it could make 10-11% in terms of TWh
FIN	The volumes of the harvested logging residues for the energy generation purposes are following the level of wood markets and market based cutting. This source of forest bioenergy is the biggest and cheapest forest-based energy type in Finland.
GER	Logging residues are not accounted for separately in the official statistics. The figures for forest fuel are shown in Table 2, see separate document. The future

	harvesting potential until 2050 has been assessed based on a tree growth model by (Schier & Weimar 2018) (WEHAM-scenarios). The results for the WEHAM basic scenario are shown in Table 4 and in Figure 1 in separate document. The total harvesting potential is decreasing and so are the logging residues.
LV	Important energy source of total supply of energy and supply, Increased supply in the last decade, currently stable. The delivery from state forests is fluctuating with decreasing tendency, deliveries from private forests are increasing.
LT	It is estimated that about 1.69 TWh of energy potentially could be obtained from logging residues.
SWE	Energy from logging residues has been decreasing since 2013, but is around the same in 2016 as in 2015. Trend for fire wood has increased since 2013. Trend for stumps is decreasing since 2013. Industrial residues bark 9,240 GWh, sawdust and chips 9,605 GWh, dry chips from industry 2,632 GWh.

4.3 Are there national policies, laws, subsidies etc. influencing the supply of energy from logging residues? If there are, explain how?	
EST	Electricity market act 59 § supporting biomass https://www.riigiteataja.ee/en/eli/528082014005/consolide
FIN	Act on Financing of Sustainable Forestry (in native language: Kestävän metsätalouden rahoituslaki) Financing shall be allocated for measures which promote the sustainable management and use of forests. The measures are 1) ensuring the sustainability of timber production; 2) maintaining the biological diversity of forests; 3) forest ecosystem management projects; and 4) other measures in support of the activities. Forestry Development Centre “Tapio” has prepared harvesting instructions/recommendations for logging residues harvesting for energy purposes. Forest industry companies pay a bonus for logging residues, if forest owner is willing to sell them to industry as part of timber purchase agreement.
GER	PEFC-standard: No use of treetops on poor soils A certain amount of dead wood has to remain in the forest for ecological reasons - FSC-standard: 10% of forest area with trees has to remain untouched as nature forest development area or area with special use for nature protection. These areas cannot be used for timber or forest fuel production. Small trees and tree tops with diameters < 7 cm cannot be used but have to remain in the forest. A significant part of energy wood or industrial wood cannot be used. In many cases, even large parts of wood > 7 cm remain unused because the necessary additional cut at 7 cm is too costly.

	- Limitation of forest management and harvesting in protected areas - Laws concerning forest management: Federal Forests Act (Bundeswaldgesetz- BWaldG), forest laws of the federal countries: Forests Act of Brandenburg: • Protection and reconstitution of the nutrient balance of soils • A sufficient quantity of dead wood has to remain in the forest Law for the protection of soils: refers the Federal Forests Act - Generally accepted standards for sustainable forest management: protection of soils, nutrient balance - Conversion of coniferous forest stands to mixed stands. The overall wood production will decrease, but the production of forest fuel might increase in the future (Oehmichen et al. 2017) unless much more dead wood is left in the forest for nature protection.
LV	The supply of energy from logging residues affects the legislation that determines action in forest and the amount of felling. There are no harvesting residues or any other type of woody biofuel related subsidies; bioenergy is supported through state investments into bioenergy applications and double electricity tariffs for certain period of time if it is produced from biomass. From the year 2016 value-added tax (VAT) is cancelled, if the purpose of logging residues usage is heating.
LT	Harvesting waste production is promoted in state forest. We certainly know what state forestry enterprises (i.e. Lithuania non-private forestry sector) during last five years participated in production and gathering of biofuels in their governed forested areas on the task of Ministry of Environment and General Directorate of States Forests, thus possibly influencing the reduction of biofuel prices and boosting biofuel use during respected period of time in Lithuania. In some cases, this activity could be perceived as indirect financial support.

4.4 Who are the main suppliers of logging residues?	
EST	State Forest Management Centre http://www.rmk.ee/en, biggest forest and wood chips companies
FIN	Forest industry companies buy the logging residues and deliver them to their own energy plants or to the plants of the third parties.
GER	Forest companies, logging companies, companies specialized in forest fuel (production, logistics, trade)
LV	Main suppliers of logging residues in forestry sector are JSC “Latvian State Forests” (LVM), harvesting companies, intermediate forest management companies, private forest owners and also farmers.
LT	State and private forest owners

4.5 What other factors influence the supply of energy from **logging residues**?	
EST	Weather and forest type - in wet forest types or with wet weather residues are used on roads transporting logs out from forest. In some forest types, there are almost now residues, for examples in certain pine forest types.
FIN	Weather conditions and the common economic booms will have an influence on the delivery volumes of the logging residues.
GER	Demand for industrial round wood and for wood fuel; level of prices - Availability/Supply of recycled wood and industrial residues (as alternative wood fuel products) and price level - Age structure of forests and tree species - Weather conditions (temperature, rainfall) - Calamities (storms, insects, …) - Framework conditions and costs for forwarding and bucking: - Volume per hectare - Forwarding distance - Main assortments (producing wood fuel might or might not be worthwhile)
LV	The factors that influence the supply of energy from logging residues are the climatic conditions - warm winter, wet summer and autumn. Another important factor is the demand in the market - the price level of logging residues. As well as in Latvia the forests usually are wet - the residues are used to increase the soil bearing capacity and avoid the damage of roots during the harvesting processes for forwarders.
LT	First and foremost, the availability and price of easier to gather wood fuels, like firewood in forest or wood fuel from abandoned land. In the future, harvesting of low-value stands dominated by grey alder for wood fuel seems inevitable; supply from logging residues might depend on possible solutions and regulations in such case made by General Directorate of States Forests, if low-value stands will be cheaper to produce biofuel in comparison to logging residues in clear-felling sites.

4.6 What are the **trends for stumps** in terms of TWh, share of total supply of energy and supply?	
EST	Stumps are not uprooted in forest and not used for energy purposes. There might be seldom cases where forestland is changed to road, building, sports facilities or other construction purposes.
FIN	The utilization of stumps in energy generation has been balanced and stabilized.
GER	Stumps does not form part of regular forest fuel production in Germany.
LV	The stumps as a share of the total supply of energy and supply are insignificant from the total offer. Stumps are produced in deforestation fellings and mixed with other biomass and do not appears in biofuel production and consumption statistics. There are studies and researches on stump extraction as a solution for

	reduction root rot spreading speed in coniferous stands, but it is not implemented yet.
LT	It is estimated that about 1.16 TWh of energy could be obtained from stumps (theoretically).

4.7 Are there national policies, laws, subsidies etc. influencing the supply of energy from **stumps**? If there are, explain how?	
EST	No
FIN	Forestry Development Centre "Tapio" has prepared harvesting instructions/recommendations for stumps harvesting for energy purposes. Forest industry companies pay a bonus for stumps in the final fellings, if forest owner is willing to sell them to industry as part of timber purchase agreement and the logging site is located optimally for the regional/local energy plant.
GER	Forest laws and certification (PEFC, FSC) exclude the extraction of stumps as part of regular forest management. Stumps are extracted only during land clearing (for building project or land mining) or when felling trees is cities, on roadsides etc.
LV	There are no restrictions for the removal of tree stumps from the forest. Forest certification schemes may prohibit stump extraction using conservative approach of evaluation of any new forest management measures.
LT	Stumps can be used from non-forestry land, which has grown vegetation over a period of 25 years and returned to agricultural land. It's possible to harvest stumps only from clear cutting, but not from all stands. Stumps cannot be taken from protected areas.

4.8 Who are the main suppliers of stumps?	
EST	Forest and woodchips companies.
FIN	Forest industry owned power plants.
GER	Companies working in land clearing or in landscape preservation
LV	Possible suppliers of stumps could be harvesting companies, which are involved in deforestation activities and intermediate forest management companies.
LT	Trade is not taking place in Lithuania due to the established tradition of trade: boiler houses that could use stumps has short-term contracts (up to half a year) with suppliers, therefore suppliers cannot assume the risk of committing stumps (their preparation takes more than a year). For this reason, the stumps are mulched or disposed of to landfills.

4.9 What other factors influence the supply of energy from **stumps**?	
EST	Local development plans.
FIN	The comparable price, availability and quality of the alternative energy particles for the energy plants.
GER	Building activity, land mining (open brown coal pits)
LV	The main factors that influence the energy supply from stumps are the limited solid biofuel demand on market for forest fuel, the technology development for heating and processing equipment and the high production and delivery cost, in compare to other types of available biofuels.
LT	There are necessary decisions at national level. The energy stock market Baltpool need to create a product of "Stump Chip" to be able to use such chips to buy, and suppliers, with the knowledge that they will be able to sell, could be prepared.

4.10 What are the **trends for wood with no industrial use** in terms of TWh, share of total supply of energy and supply?	
EST	Industrial and energy sector demands wood with increasing trend influencing price of wood fuel. It means that other energy technologies than wood, heat pumps will be attractive for non-industrial users as well.
FIN	There is a stable need and demand for wood with no industrial use in the energy wood markets.
GER	There are not statistics showing the harvested quantities of wood with no industrial use. In the following table the simulation results (prognosis) of (Schier & Weimar 2018) show the expected supply with merchantable wood (>7cm) for energy purposes until 2050 (WEHAM-basic scenario). See separate document.
LV	The wood with no industrial use as the share of total energy and supply is the main energy source. In long term, it is stable.
LT	Firewood and wood with no industrial use accounts for about 8.4 TWh of biofuels in the balance sheet. It accounts for about 2/3 of the total biofuel consumption.

4.11 Are there national policies, laws, subsidies etc. influencing the supply of energy from **wood with no industrial use**? If there are explain how?	
EST	Climate policy 2050 sets sectoral energy and resource efficiency principles http://www.envir.ee/en/news-goals-activities/climate/general-principles-climate-policy.
FIN	Act on Energy Subsidies for Small Diameter Trees (in native language: Pienpuun

	energiatuki) Subsidy for harvesting small diameter trees for energy use from sanitary cutting and thinning. The aid is paid for energy wood, which is obtained in connection with forest management from young stand tendering and first thinning sites. The aid system is based on the Act on aid for forest chips from small diameter wood from young stands (101/2011). There is a certain sum reserved in the state budget for supporting sustainable forestry in the young stands. If energy wood has been delivered to energy wood end-users and the hectare volume is over 35 m^3, the state support is paid for the forest owner up 450 €/ha.
GER	See answers for logging residues.
LV	The supply of energy from wood with no industrial use affects the legislation that determines action in forest and the amount of felling. From the year 2016 value added tax (VAT) is cancelled.
LT	There are some intentions to ban the use of chips for energy from logs larger than a certain diameter, because it could be used by furniture industry companies.

4.12 Who are the main suppliers of wood with no industrial use?	
EST	Local agricultural and forest companies.
FIN	Forest management associations for private forest owners and companies in the forest and energy industry.
GER	See answers for logging residues.
LV	Main suppliers of logging residues in forestry sector are private forest owners and farmers, harvesting companies, intermediate forest management companies and JSC "Latvian State Forests" (LVM).
LT	State and private forest owners and enterprises

4.13 What other factors influence the supply of energy from **wood with no industrial use**?	
EST	Mainly growing need for biomass energy in the Baltic Sea region.
FIN	State paid subsidies will promote at the same time good forest management and supply of energy wood to the plants.
GER	See answers for logging residues.
LV	The factors that influence the supply of energy from wood with no industrial use are the climatic conditions - warm winter, wet summer and autumn. Another

	important factor is the demand in the market - the price level. As well as the development of new processing sites in the regions influences the supply of energy from wood with no industrial use. Also, in rural regions mostly, firewood is used for the house heating.
LT	Wood with no industrial use is used for wood chips and sometimes for fibreboard. How much wood with no industrial use will they get to produce energy, and how much the fibreboard depends on the prices.

4.14 What are the **trends for industrial residues** in terms of TWh, share of total supply of energy and supply?	
EST	Industrial residues are exported or used for briquettes and granules production. More than half of energy wood comes from industrial residues. It might be that in longer run even bigger share comes from industrial residues because more different use for logging residues will be or warm and wet weather limits usage of logging residues.
FIN	The volumes are steadily increasing in Finland, when the forest industry is in the positive growth boom.
GER	The supply with industrial residues mainly depends on the production of sawn wood and to a lesser degree on the production of derived timber products. The WEHAM market model forecasts rising production when supposing the WEHAM basic scenario (tree growth) and reference scenario (market). See separate document.
LV	The industrial residues - has become a significant source of energy supply. The modern processing technologies provide qualitative residues which the supply chain can utilize.
LT	It is estimated that about 4 TWh of energy can be obtained from industrial residues.

4.15 Are there national policies, laws, subsidies etc. influencing the supply of energy from **industrial residues**? If there are, explain how?	
EST	Electricity market act §59 support to biomass producing electricity.
GER	No national policies, subsidies etc. applicable
LV	There is no national policy, law etc. restrictions. From the year 2016 value added tax (VAT) is cancelled, if the purpose of industrial residues further usage is heating.
LT	There are no restrictions or promotional programs.

4.16 Who are the main suppliers of industrial residues?	
EST	Saw mills, wood processing companies (furniture, buildings, plywood, veneer, wood details, doors and windows etc.)
FIN	Mechanical wood working industry.
GER	Sawmills
LV	The main suppliers of industrial residues are wood processing sector enterprises.
LT	Greatest sawmills in Lithuania: Stora Enso Lithuania, Sila Timber, Lycice, USG and many small sawmills.

4.17 What other factors influence the supply of energy from **industrial residues**?	
EST	Market demand and price.
FIN	Economic booms and weather conditions.
GER	Market for sawn wood, production capacities.
LT	A large part of the waste from the large wood industry is used in the production of pellets, because it prepares clean sawdust and chips without bark; a lot of waste is consumed by wood-based panels (Ikea Industry Lithuania; Klaipeda Wood; Grigeo). Of these companies, bark is mainly used for energy production.
SWE	The factors influencing on the supply of the energy from industrial residues are the availability of round wood in the market, the restrictions of import from neighbouring countries and the total volume of felling and the level of producing technology effectiveness.

4.18 What are the trends for **processed wood fuel** in terms of TWh, share of total supply of energy and supply?	
EST	Increasing due to international market demand. See chapter 10.7 of the Estonia Forest Yearbook 2016 http://www.keskkonnaagentuur.ee/sites/default/files/mets2016_08.09.pdf
GER	German producers can supply enough pellets for the domestic market. Usually, there is even an export surplus (except in the year 2016, when one of the big pellet producers went bankrupt).
LV	The processed wood fuel is a well-developed and stable growing sector with high added value. It is an important energy source of total supply of energy, but not for local heating - premium pellets for local use and industrial pellets for export.
LT	No data available.

4.19 Are there national policies, laws, subsidies etc. influencing the supply of energy from **processed wood fuel**? If there are, explain how?	
EST	Support to wood-based energy solutions given by Environmental Investment Centre https://www.kik.ee/en
GER	The production of pellets is listed as "energy intensive business". Therefore the companies do not need to pay the tax associated to the Renewable Energy Law (share of costs funding renewable energies). In Germany, pellets are not used for the production of electricity (as for instance in the Great Britain or in Sweden) but only for heating in households, single buildings or small district heating units. Hence quality is very important. The quality certificates ENplus and ENplus A1 are very important for pellet producers in Germany.
LV	There is no national policy, law etc. restrictions. From the year 2016 value added tax (VAT) is cancelled, if the purpose of industrial residues further usage is heating.
LT	There are no restrictions or promotional programs.

4.20 Who are the main suppliers of **processed wood fuel**?	
EST	Granules, wood chips and briquettes producers.
GER	Traditional energy traders (mainly companies selling and delivering heating oil), firewood dealers.
LV	The main suppliers of processed wood fuel are wood processing sector enterprises, there are several enterprises that produce pellets as one of the products, but others produce only industrial pellets.
LT	No data available.

4.21 What other factors influence the supply of energy from **processed wood fuel**?	
EST	Certification of forests and supply chain.
GER	The most important factor is the seasonal availability of residues from sawmills (better in summer). Additionally, in winter the drying of chips is more expensive, and logistics are more complicated due to weather conditions and number of staff away sick.
LV	The factors influencing on the supply of the energy from processed wood fuel are the wood processing volume, local and global market demand of pellets and briquettes.

LT	No data available.

4.22 What are the trends for **short-rotation** in terms of TWh, share of total supply of energy and supply?	
EST	Aspen stands are youngest allowed to clear cutting 30-50 years, forest act §29 https://www.riigiteataja.ee/en/eli/ee/504092017014/consolide/current But aspen is mainly used in big amounts by pulp mill http://www.Encell.ee/en/
FIN	Short-rotation based wooden biomass has no importance in Finland.
GER	Thanks to the activities of some companies in some regions the area with short rotation has increased substantially during the last years. But since 2015, the overall area with short rotation in Germany has been stagnating (FNR 2018).
LV	In Latvia, this sector of energy supply from short-rotation is not significant yet, no statistical data available. There are some studies, but no deliveries yet. There are no commercially significant applications yet, however few 100 ha of short rotation coppices are already established and will deliver few 1 000 m^3 of biomass in following years.
LT	It is estimated that from energy plantations could receive about 0.3 TWh of energy. To this group we could attach agricultural land management, packets, ditches vegetation, from which 1.9 TWh of energy can be produced.

4.23 Are there national policies, laws, subsidies etc. influencing the supply of energy from **short-rotation**? If there are explain how?	
EST	Not specific, we have unused half of grey alder mature stands, see table 1.2.5 Estonian Forest Yearbook 2016 http://www.keskkonnaagentuur.ee/sites/default/files/mets2016_08.09.pdf
GER	EU Direct payments: „Greening “ - Funding for investments in short rotation in the framework of the funding program „Improvement of the agricultural structure and coast protection “2015-2018 - Amendment of the Federal Forests Act (17.01.2017): According to 2 § arable land with short rotation coppices remains cropland (the legal status doesn’t change to forest).
LV	Available European Union support or subsidies for short rotation breeding, increased taxation of overgrown land. The plantations of short rotation coppice crops with 5-year rotation period receives area payment, like any other crop in farmlands (forest lands do not receive area payment); similarly, woody crops with 15 years rotation period also receives area payment.
LT	Until 2013 EU support for plantation production was allocated. Now there is no real support.

4.24 Who are the main suppliers of **short-rotation**?	
EST	Private forest owners.
FIN	State Energy Company Vapo and a few landowners.
GER	Farmers, agricultural service companies (many of them have direct contracts with energy companies).
LV	Short-rotation plantations, cleaning of agricultural land from overgrowth. Existing plantations are mainly established by large land owners and investment companies.
LT	The largest plantations in Lithuania are managed by Klasmann-Deilmann Bioenergy Ltd.

4.25 What other factors influence the supply of energy from **short rotation**?	
EST	It is estimated that in E low value arable land 230,000 ha that would be suitable to grow for example willow, https://energiatalgud.ee/img_auth.php/8/8a/P%C3%B5ldvere%2C_E._Energiav%C3%B5sa_Eestis.pdf, but willow is also usable in wastewater treatment http://dspace.emu.ee/xmlui/bitstream/handle/10492/2406/Bert%20Holm%20thesis.pdf;sequence=1
GER	Terms of tenancy agreements (> 20 years) - Market situation for other crops Level of knowledge about crops among farmers - Available machinery
LV	The main factor that influences the supply of energy from short rotation is the lack of subsidies for establishment of crops, small tax for landfilling of wastewater sludge and wood ash hampering alternate use of these materials. Another main factor is that at this moment there is enough logging residues to produce energy.
LT	In Lithuania, fast rotation energy plantations are established on very poorly grounded soils, therefore, plants without fertilization grow very slowly. Support for fertilization is required. There is shortage of energy plantation harvesting equipment.

4.26 What are the trends for **recycled wood-fuel** in terms of TWh, share of total supply of energy and supply?	
EST	Trends in recycled package waste (blue line), building and demolition waste (brown line) 2004-2015 are shown page 8 http://empl.ee/wp-content/uploads/2015/01/Puidubilanss-aruanne-2015-v3.pdf

	It is not said how these wastes were used. It is not allowed to burn in boilers wood with chemicals treatment.
GER	The supply with recycled wood has increased slightly between the year 2001 and the year 2016 (Döring et al. 2018a). In 2016, German recycling companies imported 250,000 tons of recycled wood.
LV	No official use or minimal individual use of recycled wood-fuel for individual energy supply.
LT	Fortum Heat, which operates a waste incineration plant, does not have information on the amount and prospects of this type of fuel.

4.27 Are there national policies, laws, subsidies etc. influencing the supply of energy from **recycled wood-fuel**? If there are explain how?	
EST	Waste act regulates recycling of wastes, including energy recovery, see waste act https://www.riigiteataja.ee/en/eli/520012015021/consolide
GER	Recycled Wood Act (Altholzverordnung -AltholzV): Definition of categories according to the expected contaminant loads; definition of possible end use per category. Federal Immission Control Act (Bundes-Immissionsschutzgesetz - BImSchG): determination which wood fuel assortment can be used in which kind of plant; therefor defining the sales markets for different forest fuels. Commercial Solid Waste Act (Gewerbeabfallverordnung - GewAbfV): - Duty for companies to separate used wood and other waste - Pre-treatment of waste, that has been mixed, so that the used wood can be recycled - Requirements for pre-treatment plants
LT	In Lithuania, due to prohibitions and restrictions, processed timber is not used for energy production. It is exported or transported to landfills.

4.28 Who are the main suppliers of **recycled wood-fuel**?	
EST	Waste stations.
GER	Recycling companies and dealers.
LT	Logistics companies and furniture industry companies.

4.29 What other factors influence the supply of energy from **recycled wood-fue**l?	
EST	Diversification of using wood waste.
GER	Lack of capacities for using recycled wood with heavy contaminant loads for

	energy production in neighbouring countries (import to Germany).
LT	No data available.

Use of Wood Fuel

	EST	FIN	GER	LV	LT	SWE
Forest fuel	5 TWh 4.9 mln m^3	37 TWh 19 mln m^3		15 TWh 7.3 mln m^3	8.2 mln m^3	56 TWh
Of which						
Logging residues	1.0 TWh 0.58 mln m^3	4.8 TWh 2.5 mln m^3	3.7 TWh	4.4 TWh 1.9 mln m^3	457,000 m^3	10 TWh
Stumps	N/A	1.5 TWh 0.76 mln m^3				0.16 TWh
Wood with no industrial use			1.2 TWh	7.3 TWh 3.7 mln m^3	5.5 mln m^3	
Firewood	3.2 TWh 1.5 mln m^3	9.4 TWh 4.9 mln m^3	19.7 mln m^3			9.6 TWh
Small wood						
Chipped wood	N/A		0.49 mln m^3			5.8 TWh
Industrial residues (Sawdust, Wood chips)	1.5 TWh 3.1 mln m^3	21.1 TWh 11.0 mln m^3		3.1 TWh 1.5 mln m^3	2.0 mln m^3	21.5 TWh
Processed wood fuels (pellets)	0.25 TWh 0.26 mln m^3	0.4 TWh 0.19 mln m^3		0.62 TWh 131,000 tons		8.4 TWh
Short-rotation	N/A	N/A			224,000 m^3	0.1 TWh
Recycled wood-fuel	N/A	1.7 TWh 0.89 mln m^3	7.7 mln tons			4.8 TWh

5.1 Comments on the figures:	
EST	Logging residues 1 TWh is included within wood chips.
FIN	* includes wood with no industrial use (firewood, small wood, chipped wood) In 2008, Finland set an optimistic target for 13.5 million m^3 forest chips in energy production by 2020. Many forest industry plants have been closed after the target setting. Energy wood sales have been decreased during many years due to low electricity price level, warm winters, big energy wood storages and good availability and price competitiveness of the alternative fuels. Secondary round

	wood share provided by forest industry in energy production is remarkable and especially the bark in the sector. (Finnish Forest Statistical Book 2017, p. 55) Volumes in cubic metres are values from the statistical data, but calorical values are derived from the relations in cubic metres. Therefore, some corrections should be done for absolutely right calorical values definitions. Short rotation wood cultivation is rare in Finland.
GER	The presented figures are derived from interviews and extrapolation in the framework of a nationally funded monitoring project. The results are used by the government as a source of information.
SWE	There are also 397 GWh in residues from parks- and gardens. 975 GWh of chips of "parts of trees from pre-commercial thinning" are included in Logging residues (Grot).

5.2 What are the trends for **logging residues** in terms of TWh, share of total use of energy and demand?	
EST	Stable. Depending on cutting volumes which have been stable as well.
FIN	The energy use peak for logging residues was in 2013. The utilization level (2.5 million cbm) of logging residues in the energy generation has been quite stable beginning from the year 2008. The industrial harvesting volumes have an impact on logging residues utilization for energy purposes.
LV	The logging residues are the main source of energy, the demand is growing because of renewable energy need. The use of harvesting residues is rather stable; the use of biomass delivered from private forests is increasing. In the period of years 2013 and 2017, five large capacity CHP and DH (district heating) were launched, that gave a rapid impact on consumption.
LT	It is estimated that it would be possible to produce twice as much waste felling as currently produced - about 1.7 TWh.

5.3 Are there national policies, laws, subsidies etc. influencing the use of energy from logging residues? If there are explain how?	
EST	Electricity production subsidy.
FIN	One third of the biomass in the logging sites are recommended to leave on the ground for fertilizing the growth of the rest of the trees in the stand.
GER	The use of logging residues in combustion plants is regulated by a number of laws and influenced by subsidies (for instance subsidies according to the Renewable Energy Law, regulation by the Federal Immission Control Act, …).
LV	There are no national policies, laws or support schemes that influences the use of

	energy from logging residues.
LT	There are currently no promotional programs. Only limited waste cutting in poor vegetation is limited.

5.4 What other factors influence the use of energy from **logging residues**?	
EST	Climate, type of forest, price of wood chips
GER	Prices, availability, quality
LV	The factors that influence the use of energy from logging residues are the technology development and accessibility of logging residues, the cost of non-renewable resources. Also important factor that influences the use of energy from logging residues are the weather condition affecting accessibility of resources. As well as another driving factor is the export of biofuel and export cost of biofuel.
LT	Higher costs of logging residues preparation (in comparison to firewood), transportation peculiarities.

5.5 What are the trends for **stumps** in terms of TWh, share of total use of energy and demand?	
GER	No information because stumps form not regular part of the forest fuel market in Germany.
FIN	The energy use peak for stumps was in 2013. The stumps use in energy generation is decreasing because of its low price competitiveness and technical quality challenges.
LV	No dedicated production and delivery of stump biofuel. The price of biofuel is not favourable to use stumps for biofuel production, because of high costs of stump extraction from forests. It is predicted that there will be an increase in deliveries of stump biofuel after year 2020, during the time of Rail Baltic railroad construction, because of deforestation.
LT	After operation of stumps, could produce about 1.2 TWh (theoretically).

5.6 Are there national policies, laws, subsidies etc. influencing the use of energy from **stumps**? If there are, explain how?	
FIN	One third of the biomass in the logging sites are recommended to leave on the ground for fertilizing the growth of the rest of the trees in the stand.
GER	The use of stump in combustion plants is regulated by a number of laws and influenced by subsidies (for instance subsidies according to the Renewable Energy Law, regulation by the Federal Immission Control Act, …).

LV	There are no national policies, laws or support schemes that influences the use of energy from stumps.
LT	Ecological requirements and high harvesting expenses prevent the use of stumps.

5.7 What other factors influence the use of energy from **stumps**?	
EST	High price, not much deforesting going on.
GER	No information because stumps form not regular part of the forest fuel market in Germany.
LV	The factors influencing on the productions of energy from stumps are the technology development and accessibility, as well as the cost of alternative types of biofuel.

5.8 What are the trends for **wood with no industrial use (firewood, small trees, chipped wood)** in terms of TWh, share of total use of energy and demand?	
EST	Increase of usage of heat pumps decreases need of wood with no industrial use.
FIN	The small trees importance is high for energy generation in this category and the aim is to use more non-commercial biomass from young stand treatment for the energy production. The energy use peak for stemwood was in 2009 because of the collapse of the economic boom. Therefore, a lot of primary production round wood lost its quality in the storages and was moved to energy purposes. Generally, it can be stated that the demand is stable and principally the positive trend is continuing.
GER	No information because stumps form not regular part of the forest fuel market in Germany.
LV	The share of energy use from wood with no industrial use is growing, because of developing production of pellets and slabs.
LT	At present, the largest segment of biofuel is the low-yielding stands. This segment in the future may increase, as there are plans to increase the cutting rate in LI in order to intensify the low-yielding stands. At present, about 8.4 TWh of this type of biofuel is produced. Probable its part may exceed 11 TWh.

5.9 Are there national policies, laws, subsidies etc. influencing the use of energy from **wood with no industrial use**? If there are explain how?	
EST	Subsidies for reconstruction of houses decrease the need for the heating.
FIN	There are subsidies for forest chips utilization for electricity production from small-sized trees harvesting plots based on the current national sustainable forestry financing system (Kemera valid till 31.12.2020).

GER	No information because stumps form not regular part of the forest fuel market in Germany.
LV	There are no national policies, laws or support schemes that influences the use of energy from wood with no industrial use.
LT	Lithuania has an annual cut-off rate. In order to ensure the supply of raw materials to the industry, cutting sawmills by means of more valuable timber stands containing less wood. Increasing the harvesting rate could provide raw materials for both the industry and the energy sector.

5.10 What other factors influence the use of energy from **wood with no industrial use**?	
EST	Climate, wood prices.
FIN	If the subsidizing system continues for young stands treatment, it is an incentive for forest owners to invest good forest management, but also for energy wood supply.
GER	No information because stumps form not regular part of the forest fuel market in Germany.
LV	The factors that influences the use of energy from wood with no industrial use are the demand in export markets, the weather conditions affecting accessibility of wood in competing countries, shipping costs and climatic conditions - warm winter, wet summer and autumn.

5.11 What are the trends for **industrial residues** in terms of TWh, share of total use of energy and demand?	
EST	Currently it is one quarter of the total use, but it could be more, because much of this is exported in granules and for cellulose production
FIN	Relative utilization of bark in energy generation increases along with the share of commercial round wood purchases and industrial production.
GER	See separate document.
LV	The trends of industrial residues use as biofuel are mainly influenced by the situation in pellets production sector. The consumption in the transformation sector is growing
LT	The amount of industrial waste depends on the development of the wood industry. For the time being, no increase in industrial residues market is expected, so their numbers have to remain similar.

5.12 Are there national policies, laws, subsidies etc. influencing the use of energy from **industrial residues**? If there are, explain how?	
EST	Electricity production subsidy.
GER	Residues from sawmills are biomass according to the Biomass Act (Biomasseverordnung - BiomasseV) and can be used in combustion plants, who want to profit from subsidies according to the Renewable Energy Act.
LV	There are no national policy, law etc. Restrictions affecting industrial residue usage for energy production.

5.13 What other factors influence the use of energy from **industrial residues**?	
EST	New possibilities for domestic use.
GER	Current situation of buying and selling markets
LV	The factors influencing on the use of energy from industrial residues are the demand from the industry and the arrival of new producers or products.
LT	The development of wood industry is limited by raw material shortages, logistical difficulties, and strong competition from producers in neighbouring countries.

5.14 What are the trends for **short-rotatio**n in terms of TWh, share of total use of energy and demand?	
EST	We have no short-rotation.
FIN	N/A (not applicable)
GER	See separate document
LV	There are no commercially significant applications yet, however few 100 ha of short rotation coppices are already established and will deliver few 1,000 m^3 of biomass in following years.
LT	The development of wood industry is limited by raw material shortages, logistical difficulties, and strong competition from producers in neighbouring countries.

5.15 Are there national policies, laws, subsidies etc. influencing the use of energy from **short-rotation**? If there are explain how?	
GER	Subsidies according to the Renewable Energy Law - regulation by the Federal Immission Control Act
LV	There are no policies affecting use of short rotation usage for energy production.

5.16 What other factors influence the use of energy from **short rotation**?	
EST	We have plenty of low quality wood in the forest.
GER	Short rotation plantations in the vicinity, quality of wood chips (ash content, water content, shape and size)
LV	The main factors influencing on the use of energy from short rotation are the distribution of funding in Rural development programme, and the cost of alternative types of biofuel.
LT	The development of plantations may be limited by expensive land, limited technical quantities, little gain.

5.17 What are the trends for **recycled wood-fuel** in terms of TWh, share of total use of energy and demand?	
FIN	Pellets production is increasing, but the increase is absolutely small.
GER	See separate document.
LV	No use of recycled wood fuel in energy production. Or individual use is not statistically available.
LT	No data available.

5.18 Are there national policies, laws, subsidies etc. influencing the use of energy from **recycled wood-fuel**? If there are explain how?	
GER	Recycled Wood Act - Federal Immission Control Act

5.19 What other factors influence the use of energy from **recycled wood-fuel**?	
GER	Available quality of recycled wood (contaminant load, chip quality) - Market for other forest fuels
LT	No data available.

Use of Wood Fuel by Sectors in Countries

Estonia

TWh	Industry	District Heating	Electricity Production	Transport	Residental and Service
Total Wood Fuel	0.3	8.65	1.13		4.57
Of which Forest Fuel	0.3	8.65	1.13		4.57
Of which					
Logging residues	0	0	0	0	0
Wood with no industrial use					
Stumps	0	0	0	0	0
Firewood	0.02	6	1.12	0	4.33
Small trees	0	0	0	0	0
Chipped round wood	0	0	0	0	0
Industrial residues (Sawdust, Wood chips)	0.28	2.13	0.01	0	0
Processed wood fuels (pellets)	0.01	0.52	0	0	0.24
Short-rotation	N/A	N/A	N/A	N/A	N/A
Recycled wood-fuel	N/A	N/A	N/A	N/A	N/A

Finland

TWh	Industry	District Heating	Electricity Production	Transport	Residental and Service
Total Wood Fuel	11.6	14.3	12.6	0	38.5
Of which Forest Fuel	8.8	3.7	3.3	0	15.7
Of which					
Logging	N/A	N/A	N/A	N/A	N/A

residues					
Wood with no industrial use Stumps Firewood Small trees Chipped round wood	N/A	N/A	N/A	N/A	N/A
Industrial residues (Sawdust, Wood chips)	N/A	N/A	N/A	N/A	N/A
Processed wood fuels (pellets)	N/A	N/A	N/A	N/A	N/A
Short-rotation	N/A	N/A	N/A	N/A	N/A
Recycled wood-fuel	N/A	N/A	N/A	N/A	N/A

Latvia

TWh	Industry	District Heating	Electricity Production	Transport	Residental and Service
Total Wood Fuel	3.8	4.7	0.5	0	6.3
Of which Forest Fuel	3.8	4.7	0.5	0	6.3
Of which					
Logging residues	0.76	2.71	0.39	0	0.1
Wood with no industrial use Stumps Firewood Small trees Chipped round wood	0.71	1.81	0.1	0	5.45
Industrial residues					

(Sawdust, Wood chips)	2.35	0.13	0.03	0	0.17
Processed wood fuels (pellets)	0.03	0.04	0	0	0.59
Short-rotation	0	0	0	0	0
Recycled wood-fuel	0	0	0	0	0

Lithuania

TWh	Industry	District Heating	Electricity Production	Transport	Residental and Service
Total Wood Fuel	1.1	4.9	0.3	0	4.9
Of which Forest Fuel	1.1	4.4	0.3	0	4.9
Of which					
Logging residues	0	0.9	0	0	0
Wood with no industrial use Stumps Firewood Small trees Chipped round wood	1.1	0.04	0	0	0
Industrial residues (Sawdust, Wood chips)	0	3.4	0	0	0
Processed wood fuels (pellets)	0	0	0	0	0
Short-rotation	0	0.5	0	0	0
Recycled wood-fuel	0	0	0	0	0

Sweden

TWh	Industry	District Heating	Electricity Production	Transport	Residental and Service
Total Wood Fuel	51	0	0	0	
Of which Forest Fuel					14
Of which					
Logging residues	0	0	0	0	11
Wood with no industrial use Stumps Firewood Small trees Chipped round wood	0	0	0	0	0
Industrial residues (Sawdust, Wood chips)	0	0	0	0	0
Processed wood fuels (pellets)	0	0	0	0	3
Short-rotation	0	0	0	0	0
Recycled wood-fuel	0	0	0	0	0

6.1 Comments on the figures:	
EST	* includes wood with no industrial use including firewood. Wood chips 1.1 TWh were used to produce 0.8 TWh electricity. Boilers produced 2.4 TWh and CHPs 1.8 TWh heat from wood, it is mostly for district heating. In residential and service was wood fuel end use 4.6 TWh (including residential 4.5 TWh) in 2016. 4.6 million m^3 wood fuel was used domestically in 2016, including 1.5 million m^3 firewood and 3.1 million m^3 wood chips and waste. Wood granules and briquettes were used 111,000 tons. All figures from 2016.
FIN	There is no ready statistics available for forest fuel division. The given numbers are provided by the statistics of the Finnish Energy Industry Association (Energiateollisuus ry). The forest industry company UPM started its biodiesel production in south-eastern Finland in Lappeenranta Kaukas mill area in the

	beginning of 2015. They have a brand BioVerno which is sold in retail gasoline stations ST1. The volumes are increasing, but the current level is not big. Therefore transport column is not filled up with the statistical numbers.
GER	No information on use of wood fuels by sector available.
LV	Source: Forest and Wood Products Research and Development Institute (abbreviated as MeKA) and information from Latvian Energy balance in 2016. Distribution of use of stumps and short rotation is estimated using expert judgement. All figures from 2016.
LT	Statistics Lithuania, Baltpool, Energy exchange, 2018, National Commission for Energy control and Prices. Some of data are newer here, that's why it's not possible to compare data with data from 3 Biofuels part. Most figures from 2016 except for district heating where most figures are from 2017 (wood with no industrial use are from 2016).

6.2 What are the trends for wood fuels in the industry sector in terms of TWh, share of total use of energy and demand?	
LV	The consumption of wood fuels use in industry sector is stable and growing. A rapid increase takes place during the recent years due to increase of pellets and boards production.
LT	By the calculations of LITBIOMA (Lithuania Biomass Energy Association), in 2020 planned share of total use of wood fuels in industry sector will rise to 50% of total demand comprising 190,000 toe (tons of oil equivalent), in comparison to respective numbers of 32% and 120,000 toe in 2016.

6.3 Who are the main customers of wood fuel in the industry sector? Specify by assortment, if possible.	
EST	Wood granule producers, furniture producers
LV	The main customers in the industry sector are pellet and boards manufacturers and exporters.
LT	No data available.

6.4 Are there national policies (laws, subsidies etc.) influencing the use of energy from biofuels in the industry sector? If there are, explain how?	
EST	Electricity excise distinction is coming.
LV	No dedicated policies, if repayment of VAT is not considered for exported goods (applies to pellet industry). It is planned that in will be some possible projects for industrial enterprises to change the heating from fossil to bioenergy.

6.5 What other factors influence the use of biofuel in the industry sector?	
EST	If it has its own wastes.
LV	The factors influencing on the use of biofuel in the industry sector are the total supply, technology development of CHP, the demand of pellets in household and industrial applications in European markets, availability of raw materials for pellet production.

6.6 What are the trends for wood fuels in the district heating sector in terms of TWh, share of total use of energy and demand?	
EST	Half of heat production comes from wood, rest is mostly from natural gas as well as oil shale.
LV	In the district heating sector, the wood fuel usage is fast growing in the last decade with a positive forecast (about + 20%) till year 2020. The local consumption is slightly increasing during recent years.
LT	By the calculations of LITBIOMA (LI Biomass Energy Association), in 2020 planned share of total use of wood fuels in district heating sector will rise to 80% of total demand comprising 640,000 toe, in comparison to respective numbers of 64% and 510,000 toe in 2016. The use of fossil fuel will decrease accordingly.

6.7 Who are the main customers of wood fuels in the district heating sector? Specify by assortment, if possible.	
EST	Heating companies: Utilitas, Fortum, Adven, SW Energia etc.
LV	The main customers of wood fuel are DH (district heating) and CHP (combined heat and power) system operators. There is a growing trend in wood fuel usage in farming sector.
LT	The main customers of wood fuels in the district heating sector are: UAB "Danpower Baltic" - 195 MW; UAB "Litesko" - 102 MW; UAB "Vilniaus šilumos tinklai" - 72 MW; AB "Panevėžio energija" - 90 MW; AB "Kauno energija" - 79 MW. All of them mostly consume chipped firewood.

6.8 Are there national policies (laws, subsidies etc.) influencing the use of energy from biofuels in the In district heating sector? If there are explain how?	
EST	Energy management development plan 2030.
LV	Few years ago, there were an EU support for district heating plant modernisation and change to bioenergy use for heating, but now the support has ended.

LT	No national policy is substantiated in the form of official laws or subsidies. However, we certainly know what State's forestry enterprises (i.e. Lithuanian non-private forestry sector) during last five years participated in production and gathering of biofuels in their governed forested areas on the demand of Ministry of Environment and General Directorate of States Forests, thus possibly influencing the reduction of biofuel prices and boosting biofuel use during respected period of time in Lithuania. At the moment, such policy has been stopped due to major overhaul and reform of State's forestry sector during 2017-2018 and possibly not to be reiterated again.

6.9 What other factors influencing on the use of biofuel in the district heating sector?	
EST	Fuel price.
LV	The main factor that may influence the use of biofuel in district heating sector is the society desire to become greener and the non-renewable resource constraints and depletion. Also, as one of possible influences could be the support to electricity production from non-renewable sources.
LT	In general, business in district heating sector in Lithuania has plenty of monopoly indications, such as possession of heat production and heat distribution installations in one hands. Under such circumstances small or independent from existing companies' bodies faces plenty of difficulties by entering the heat production market.

6.10 What are the trends for wood fuels in the electricity production sector in terms of TWh, share of total use of energy and demand?	
EST	Total electricity production 2016 was 12.1 TWh, domestically was used 7.6 TWh. Wood fuels gave 9% of total electricity production.
LV	The wood fuel use in the electricity production sector is considered as a rapid growth during recent years, more than 10 times since year 2008.
LT	By the calculations of LITBIOMA (Lithuanian Biomass Energy Association), in 2020 planned share of total use of wood fuels in electricity production sector will rise to 15% of total demand comprising 68,000 toe, in comparison to respective numbers of 5.5% and 25,000 toe in 2016.

6.11 Who are the main customers of wood fuel in the electricity production sector? Specify by assortment, if possible.	
EST	CHPs in district heating and in pellet industry.
LV	The main customers of wood fuel in the electricity production sector are the CHP.

LT	UAB "Vilniaus šilumos tinklai" 27 MW; AB "Šiaulių energija" 10 MW

6.12 Are there national policies (laws, subsidies etc.) influencing the use of energy from biofuels in the electricity production sector? If there are, explain how?	
EST	Electricity production from renewables supported by electricity market act 59 § https://www.riigiteataja.ee/en/eli/528082014005/consolide Biomethane production pilots got support.
FIN	Production subsidies for renewable electricity The Act on Production Subsidy for Electricity Produced from Renewable Energy Sources (1396/2010) (in native language: Laki uusiutuvilla energialähteillä tuotetun sähkön tuotantotuesta) Decree on Production Subsidy for Electricity Produced from Renewable Energy Sources (1397/2010 (in native language: Valtioneuvoston asetus uusiutuvilla energialähteillä tuotetun sähkön tuotantotuesta) Wind, biogas and small-scale woody biomass based electricity generation is supported by a feed-in tariff mechanism. The plants must be new to be eligible. For electricity produced in a woody biomass or a biogas CHP plant, an increased tariff is paid in the form of a heat premium if heat is produced for utilization and the overall efficiency of the plant meets the required standards. The applicable biomass types are limited to those “delivered directly from forests” (branches, tops, stumps, small diameter wood). The regulation was adopted to ensure that wood suitable for forest industry will not be used as energy. The maximum duration for both mechanisms is 12 years.
LV	Double tariff for electricity production from renewable sources for certain period of time. Subsidy to encourage the electricity production form bioenergy.
LT	Government of Lithuanian financially supported the construction of "green" (including powered by wood fuels) instalment generating electricity via high prices of electricity procurement, but till 2013 only. Therefore, the construction of small private power plants decreased significantly during last 5 years.

6.13 What other factors influence the use of biofuel in the electricity production sector?	
EST	Prices of fuel, electricity, technology.
LT	No data available.

6.14 What are the trends for wood fuels in the transport sector, in terms of TWh, share of total use of energy and demand?	
EST	No trends.
LT	The demand of biofuels in transport sector will rise, if the State's proposal about increment of biofuels use in public transport will be realized. The possible share of wood fuels in this sector is difficult to estimate, though it should not be high.

6.15 Who are the main customers of wood fuel in the transport sector? Specify by assortment, if possible.	
EST	Biomethane is used by public transportation, currently two biomethane production sites are under development.
LT	No data available.

6.16 Are there national policies (laws, subsidies etc.) influencing the use of energy from biofuels in the transport sector? If there are, explain how?	
EST	Support https://www.kik.ee/en/supported-activity/production-biomethane-and-promoting-its-use-transportation
FIN	Act on the promotion of the use of biofuels for transport (446/2007) (in native language: Laki biopolttoaineiden käytön edistämisestä liikenteessä) The energy content of biofuels must account for 20.0 per cent of the total energy content of the petrol, diesel oil and biofuels delivered by the distributor for consumption in 2020.
LV	Requirement to add certain proportion of renewable fuel to liquid biofuel, normally the renewable fuel is originated from agricultural crops.
LT	According to Ministry of Energy of the Republic of Lithuania, there is ongoing debate on raise biofuels consumption in transport (public transport especially) sector to at least 0.5% of total used energy share to meet corresponding EU Directives.

6.17 What other factors influence the use of biofuel in the transport sector?	
EST	Oil price and development of technologies.

6.18 What are the trends for wood fuels in the residential and service sector, in terms of TWh, share of total use of energy and demand?	
EST	It has been around 4.3 TWh, total heat use in residential and service sector was 5.6 TWh.

LV	Historically high consumption.
LT	By the calculations of LITBIOMA (Lithuania Biomass Energy Association), in 2020 planned share of total use of wood fuels in electricity production sector will drop to 75% of total demand comprising 470,000 toe, in comparison to respective numbers of 80% and 500,000 toe in 2016.

6.19 Who are the main customers of wood fuels in the residential and service sector? Specify by assortment, if possible.	
EST	Heating companies and local boilers.
LV	Private house heating. Assortment shown on table above.
LT	Individual houses and blocks of flats. Individual houses are heated mainly by firewood, blocks - firewood and chipped wood.

6.20 Are there national policies (laws, subsidies etc.) influencing the use of energy from biofuels in the residential and service sector? If there are, explain how?	
EST	Reconstruction requirements and activities will reduce need to heat http://www.kredex.ee/en/energy-efficiency/
LV	Reduced VAT - 12% Climate financial instrument (not active now) supported conversion of heating systems from fossil fuels to renewable fuel covering 50% of investments.

6.21 What other factors influence the use of biofuel in the residential and service sector?	
EST	Heat pumps in total 735 MW have been installed. There are 5,000 MW boilers, including 1,161 MW wood boilers. 2005-2016 total capacity of wood fuel boilers increased 28%.
LV	Cost of non-renewable resources, pellet boiler popularity and convenience.
LT	This sector of wood fuels will shrink due to intensive emigration from Lithuanian rural areas and tendency to replace individual wood-powered heating plants with geothermal solutions in newly build real estate.

Prices on Wood Fuels in the Countries

Estonia

	Price €/KWh	Price €/volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel				
Logging residues	0.016	12.17	bulk m^3	2017
Stumps	0.01	N/A		
Wood with no industrial use	0.016	32	m^3	2017
Industrial residues (Sawdust, Wood chips, Bark)	N/A	15	bulk m^3	2017
Processed wood fuels (pellets)	N/A	N/A		
Short-rotation	N/A	N/A		
Recycled wood-fuel	N/A	N/A		

Finland

	Price €/KWh	Price €/volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel				
Logging residues	N/A	3.24	m^3	2016
Stumps	N/A	1.54	m^3	2016
Wood with no industrial use	N/A	4.32	m^3	2016
Industrial residues (Sawdust, Wood chips, Bark)	N/A	N/A		
Processed wood fuels (pellets)	N/A	N/A		
Short-rotation	N/A	N/A		
Recycled wood-fuel	N/A	N/A		

Germany

	Price €/KWh	Price €/volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel				
Logging residues	N/A	11.5-15.0	m^3 (loose)	2017-2018
Stumps	N/A	N/A		
Wood with no industrial use Firewood	N/A	50-100	m^3 (stacked)	2017-2018
Industrial residues Wood chips	N/A	80-110	tonnes (dry matter)	2017-2018
Sawdust	N/A	60-80	tonnes (dry matter)	2017-2018
Bark	N/A	8.5-12.0	m^3 (loose)	2017-2018
Processed wood fuels Pellets	N/A	220-275	tonnes	2017-2018
Short-rotation Wood chips	N/A	12.0-14.0	m^3 (loose)	2017-2018
Recycled wood-fuel	N/A	N/A		

Latvia

	Price €/KWh	Price €/volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel				
Logging residues	0.009	17.5	m^3	2016
Stumps	0.013	11.47	m^3 (loose)	2016
Wood with no industrial use (firewood)	0.011	22.0	m^3	2016
Industrial residues (wood chips, sawdust, bark)	0.010	20.0	m^3	2016
Processed wood fuels (pellets)	0.025	116.0	tonnes	2016
Short-rotation	0.011	9.77	m^3 (loose)	2012
Recycled wood-fuel	N/A	N/A		

Lithuania

	Price €/KWh	Price €/volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel				
Logging residues	0.01	19.25	m^3 (solid)	2018
Stumps	N/A	40	m^3	2012
Wood with no industrial use (firewood)	0.014	24-26	m^3 (solid)	2018
Industrial residues Wood chips Sawdust Bark	 0.016 0.008 N/A	 32 13 N/A	 m^3 (solid) m^3	 2018 2018
Processed wood fuels (pellets)	N/A	N/A		
Short-rotation	0.009	18	m^3 (solid)	2018
Recycled wood-fuel	31.7 €/MWh	368	tonnes	2018

Sweden

	Price €/KWh	Price €/volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel				
Logging residues	0.01836	N/A	m^3 (solid)	2017
Stumps	N/A	N/A		
Wood with no industrial use (firewood)	N/A	N/A		
Industrial residues (wood chips, sawdust, bark)	0.0155	N/A		2017
Processed wood fuels (pellets)	0.02713	N/A		2017
Short-rotation	N/A	N/A		
Recycled wood-fuel	N/A	N/A		

7.1 Comments on the figures:	
EST	December 2017: firewood 25.33 €/m^3 + VAT, district heating from wood chips for the end user 50-60 €/MWh + VAT.
FIN	Prices are related to the sales on the site without harvesting costs. The respective prices for energy materials ready for the transportation on the roadside are for logging residues – 14.81 €/m^3, for stumps – 13.36 €/m^3 and for small-sized wood – 22.74 €/m^3. Generally, the energy wood prices on stumpage sales were rising in Finland in 2016, where as in the delivery sales the price tendency was decreasing. The Finnish private forest owners have also received subsidies from the state for small-sized tree harvesting. The state promotes the young stands treatment operations in this sense. The treatment sites accepted for subsidies can receive 430-450 € per a hectare, which accounts for about 9 € per cubic metre.
GER	Data source: Interviews with experts; Pellets: Information of the German Pellet Institute
LV	Research results based prime cost is provided in the calculation for logging residues, stumps and short rotation. Actual market cost usually is higher and depends from demand/availability ratio. In short rotation plantations cost of establishment of plantation (about 2,290 €/ha) is included in calculation assuming 15 years investments turnover period.
LT	Recycled wood-fuel included wood pellets. Wood with no industrial use included soft deciduous, hard deciduous, coniferous wood. Sources: Baltpool, Energy exchange 2018, Lithuania Confederation of Renewable Resources 2012, Directorate General of State Forests 2018.
SWE	Prices are for district heating. There are small differences for industry use.

7.2 What are the price trends for logging residues?	
EST	2017 autumn was very rainy and wet. Therefore prices for the next year will be probably higher.
GER	Since 2003 increasing prices until 2015, when prices decreased a lot. See separate document.
LV	The prices for logging residues are currently under evaluated, because the production capacity is unused. Prices are lower compared to Estonia and Lithuania.
LT	Demand of biofuel still exceed supply level, thus raising the annual price of logging residues in the biofuel auction of the first half-year in 2018 by 39% (compiled only by data of State's forestry sector). The tendency of mounting prices remains in the future as well, yet not such drastic.

7.3 What factors influence the price of logging residues?	
EST	Exporting prices are much higher than local prices and this will increase the domestic prices also.
GER	Regional availability of industrial round wood, residues from sawmills and recycled wood.
LV	The factors influencing on the price of logging residues are the supply and demand in the market. Also influences related to the climatic conditions - warm winter, wet summer and autumn and the travel distances. As another influencing factor, should be considered new CHP and district heating projects in the border area or close overseas, as well as the demand at the export markets. The private forest average area is small – about 10 ha, the compartment is not bigger than 1 ha – that determines the logging amount of logging residues from one felling area.
LT	The main influencing factor is availability and price of more desirable and easier gatherable sorts of wood fuel: firewood, wood industry residues. In Lithuania, logging residues had tendency to be less popular choice for wood fuel suppliers after the options, described above due to the demand of special heavy machinery, as well as price and seasonality of harvesting in the forest. Prices may exhibit pronounced annual fluctuations depending of winter temperatures; harvesting in warm winters under plus temperature conditions may incline higher expenses or lesser supply of productions due to limitation of heavy machinery use on wet forest soils.

7.4 What are the price trends for stumps?	
EST	No statistics.
GER	No information.
LV	Price of stump biomass from deforestation fellings is considerably higher than prime cost; no commercial scale stump biomass production takes place.
LT	There is no demand of stumps as biofuel in Lithuania now, will be (very likely) during next five years. No official announcements for including stumps to biofuel assortment have been made as well. Nowadays, stumps are available in small amounts as leftovers from road building, and often are available for free. Very few power plants can utilize this type of fuel due to high ash content.

7.5 What factors influence the price of stumps?	
EST	Costly technology, low need for stump removal. Depends on the demand for building roads.

GER	No information.
LV	The main factors influencing on the price of stumps are the demand in market, applied extraction technology and the fuel price.
LT	No demand - no analysis.

7.6 What are the price trends for wood with no industrial use?	
EST	Stable trend.
GER	No separate statistics available.
LV	The demand defines the price trends for wood with no industrial use. The price affects the production capacity of pellets and boards. In the second quarter of 2017, there was a sharp increase in prices, as suggested by climatic conditions and increasing processing capacity.
LT	Price of the wood with no industrial use (including firewood) in state forestry sector from the beginning of 2017 raise by 30%. Further climb up is the most possible scenario due to upcoming of heat and electricity producing instalments, yet less drastic.

7.7 What factors influence the price of wood with no industrial use?	
EST	Depends on climate and availability of fuel.
GER	No separate statistics available.
LV	The factors influencing on the price of wood with no industrial use are the supply and demand on the market, the climatic conditions - warm winter, wet summer and autumn and the demand from industry, as well as the demand for pellets in export markets. Actually, the export market outbreaks are significant.
LT	Development of furniture trade in surrounding countries in the future may lead to more substantial import of wood with no industrial use and marginally influence the drop on prices.

7.8 What are the price trends for industrial residues?	
EST	Increasing prices. In Europe, there will be more demand for industrial residues.
GER	No separate statistics available.
LV	The demand for pellets in export markets affects the price level of residues.
LT	During the last 16 months price on sawdust, as main industrial residues for wood fuel, increased by 52% to 46 €/m^3. Price increased due to general wood fuel boost in Lithuania as well as export of granulated sawdust to Western European

	countries. Prices might slightly drop off-heating season, yet remain generally high.

7.9 What factors influence the price of industrial residues?	
EST	Availability of forest fuel.
GER	No separate statistics available.
LV	The factors influencing on the price of industrial residues are the demand from industry and the new producer emergence in the market.
LT	High demand and competition between wood fuel suppliers; limited and quiet stable supply of sawdust from industry.

7.10 What are the price trends for processed wood based fuel?	
EST	Trend is increasing.
GER	See separate document.
LT	No analysis available.

7.11 What factors influence the price of processed wood-fuel?	
EST	Scandinavia's and Denmark's need for wood fuel.
GER	Quantity delivered per delivery; quality, season, regional availability.
LV	The factors influencing on the price of processed wood fuel are the demand from residential sector and export markets, as well as the climatic conditions - warm or cold winters. EU Directives - for Industrial pellets (depending on the Europe).
LT	No analysis available.

7.12 What are the price trends for short-rotation?	
EST	No trend.
GER	No information.
LV	No commercial scale production takes place yet.
LT	Due to small scale of short-rotation business in Lithuania, price of short-rotation wood fuel is more influenced by general wood fuel market trends (especially by firewood prices) instead of expenses in short-rotation business itself. Thus short-rotation production trends depend entirely on trends of

	firewood and logging residues prices.

7.13 What factors influence the price of short-rotation?	
GER	No information.
LV	The factors influencing on the price of short rotation are the total area of short rotation crops, the travel distances, weather conditions during harvesting season and the fuel price.
LT	Small scale of short-rotation business was most delimiting factor. Such tendency should be less important in the future, if area of short-rotation plantations will consistently rise (during last 5 years, area of short-rotated plantations increased from ~ 500 to ~ 4,000 ha). Less important factors on prices are shortage on modern harvesting machinery, demand on interim storage of production and inability to fulfil demands of the market in timely fashion (related to small area of plantations).

7.14 What are the price trends for recycled wood-fuel?	
EST	Availability of forest fuel.
GER	No information.
LT	Wood pellets price increased from 28 to 30 €/MWh (from 2014 to 2017).

7.15 What factors influence the price of recycled wood-fuel?	
EST	Availability of forest fuel.
GER	No information.
LT	No data available.

Sourcing Costs on Wood Fuels in the Countries

Estonia

	Price €/ KWh	Price €/ hectare	Price €/ volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel					
Logging residues	0.0064	N/A	5.08	m^3 (bulk)	2017
Stumps	0.004	N/A	N/A		
Wood with no industrial use	0.0064	N/A	12.8	m^3	2017
Industrial residues (Wood chips, Sawdust)	N/A	N/A	6.0	m^3 (bulk)	2017
Processed wood fuels	N/A	N/A	N/A	N/A	
Short-rotation	N/A	N/A	N/A	N/A	
Recycled wood-fuel	N/A	N/A	N/A	N/A	

Finland

	Price €/ KWh	Price €/ hectare	Price €/ volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel					
Logging residues	N/A	N/A	11.57	m^3	2016
Stumps	N/A	N/A	11.82	m^3	2016
Wood with no industrial use	N/A	N/A	18.42	m^3	2016
Industrial residues (Sawdust, Wood chips)	N/A	N/A	N/A	N/A	
Processed wood fuels (pellets)	N/A	N/A	N/A	N/A	
Short-rotation	N/A	N/A	N/A	N/A	
Recycled wood-fuel	N/A	N/A	N/A	N/A	

Germany

	Price €/ KWh	Price €/ hectare	Price €/ volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel					
Logging residues	N/A	N/A	4.5-8.0	m^3 (loose) incl. forwarding and chipping	2017
Stumps	N/A	N/A	N/A	N/A	N/A
Firewood	N/A	N/A	20 € 40-80 €	Length of 1-3 metres Ready for use m^3 (stacked)	
Wood with no industrial use	N/A	N/A	12.8		2017
Industrial residues (Wood chips, Sawdust)	N/A	N/A	6.0		2017
Processed wood fuels	N/A	N/A	N/A	N/A	
Short-rotation	N/A	N/A	10.0-12.0	m^3 (loose) wood chips	
Recycled wood-fuel	N/A	N/A	N/A	N/A	

Latvia

	Price €/ KWh	Price €/ hectare	Price €/ volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel					
Logging residues	0.0075	1 690.00	6.76	m^3 (loose)	2016
Stumps	0.0127	1 720.50	11.47	m^3 (loose)	2016
Firewood					
Wood with no industrial use	0.0135	847.70	12.11	m^3 (loose)	2016
Industrial residues (Wood chips, Sawdust)	0.0050		4.53	m^3 (loose)	2016
Processed wood fuels	0.1111		100.00	m^3 (loose)	2016

Short-rotation	0.0109	1 465.50	9.77	m^3 (loose)	2012
Recycled wood-fuel	0.0050		4.53	m^3 (loose)	2016

Lithuania

	Price €/ KWh	Price €/ hectare	Price €/ volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel					
Logging residues	N/A	N/A	35.0	m^3	2014
Stumps	N/A	N/A	N/A		
Firewood	N/A	N/A	N/A		
Wood with no industrial use	N/A	N/A	28.0	m^3	2014
Industrial residues (Wood chips, Sawdust)	0.016	N/A	32.0	m^3 (solid)	2018
Processed wood fuels	0.018	N/A	35.0	m^3	2008
Short-rotation	N/A	240.0	10.0	tonnes (dry weight)	2016
Recycled wood-fuel	N/A	N/A	20.0	piled volume	2018

Sweden

	Price €/ KWh	Price €/ hectare	Price €/ volume	Volume specification (solid cubic meters, tonnes, piled volume etc.)	Year
Forest Fuel					
Logging residues			18.05	m^3 (solid)	2016
Stumps			20.51	m^3 (solid)	2015
Firewood					
Wood with no industrial use			15.08	m^3 (solid)	2016
Industrial residues (Wood chips,	15.07				2017

Sawdust)					
Processed wood fuels	25.95				
Short-rotation					
Recycled wood-fuel	7.18				2017

8.1 Comments on the figures:	
EST	2015 Cost of pellet 40 €/MWh https://energiatalgud.ee/img_auth.php/a/ac/Kaasik%2C_H._Sooja_tootmine_puidugraanulitega_%E2%80%93_m%C3%B5istlik_ja_t%C3%A4nap%C3%A4evane._2015.pdf
FIN	Original statistical prices are €/m3 and they are formed by calculating the difference between the sales prices on the stump and in the roadside pile.
GER	*costs for logistics, depends on transport distance Data source: interviews with experts
LV	Prime cost does not include profit margin and administrative costs, 10-30% from prime cost. Calculation is based on service costs obtained in research projects.
LT	Short-rotation cost of production included just harvesting costs using EcoWillow model (Source: Konstantinavičienė, 2017).
SWE	Skogforsk annual forest fuel questionnaire regarding costs in harvest, decomposition and transportation etc. and for sawdust, bark and processed wood fuels EM price statistics 2017, quarter 4.

8.2 What are the cost trends for harvesting logging residues?	
EST	Stable
GER	Constant level, increase expected: - In average the quantity/hectare is decreasing, because a lot of material has been produced in when preparing new logging trails (adapted to harvester logging). - Energy and transport costs are rising.
LV	The cost trend of harvesting logging residues is rather stable during years.
LT	With rising salaries, rising fuel prices, rainy summers, and warm and wet winters, there is a tendency to increase the cost of harvesting waste.

SWE	2009 were cost to the end customer (landowners + harvest + reduction + transport + storage) at 173 SEK/m^3. Costs went up to 185 SEK/m^3 in 2011, according to several new entrants on the then growing market leading to increased compensation to the landowner and larger volumes, even from more inaccessible and remote areas. Costs from 2013 onwards stabilised around 176 SEK/m^3.

8.3 What factors influence the cost of harvesting logging residues?	
EST	Operating costs, transportation, wages in forestry and price for the landowner for the residues.
GER	Quantity per hectare and forwarding distance.
LV	The factors influencing the cost of harvesting logging residues are the fuel price, organization of work (proper selection of stands and landing sites), labour costs, delivery distance and the size of felling area.
LT	Draw distance, conditions for logging, salaries and fuel costs.
SWE	Land owner compensation + harvest + making chips+ transport + storage. Demand and supply are influencing factors on the availability volume which depends on the volume of timber species mixture (more spruce gives more branches and tops), the volume of total withdrawals depends of the number of stems/hectare and average height. In addition, soil conditions on wet land required more branches and tops in the way to prevent land damage. Weather during the operational felling time also has an influence, how much the branches and tops that are needed to be put in the way.

8.4 What are the cost trends for harvesting stumps?	
EST	Stable
LV	No commercial scale production takes place.
LT	Average price of stumps harvesting in 2013 was 32 €/m³. Price calculated using experience from other countries (Institute of Forestry, 2013). Use of stumps for biofuel in Lithuania is not common. It's possible to harvest stumps only from clear cutting.
SWE	2009 was the management and replacement cost 174 SEK/m^3. As the demand increased and several actors (learning curve) came out on the market, the cost increased to 183 SEK/m^3 in 2011 and then 195 SEK/m^3 in 2013. Now there is no harvesting of stumps.

8.5 What factors influence the cost of harvesting stumps?	
EST	Operating costs, wages in forestry and transportation.
LV	The factors influencing on the costs of harvesting stumps are the applied technology, transport distances and relocation cost of stumps.
SWE	Soil condition, number of large spruce stumps on the local area, as well as distance for extracting to road.

8.6 What are the cost trends for harvesting wood with no industrial use?	
EST	Stable.
GER	Constant level.
LV	Cost increases with increase of transport price.
SWE	Small dimension timber (partly limbed and whole tree parts) was taken out on a small scale in 2009 and costed 165 SEK/m^3. When you then started taking out more you also went down in dimensions.

8.7 What factors influence the cost for harvesting wood with no industrial use?	
EST	Wages in forestry, operating costs, transportation and availability of forest fuels.
GER	Quantity per hectare and forwarding distance.
LV	Fuel price, transport distances, applied harvesting technologies
LT	Production conditions, fuel costs (with higher extraction distance, more fuel needed), salaries.
SWE	For partly limbed assortments and in early thinning the cost is influenced by the dimension on felled stems and the density of the stand and the distance for extracting to the road. When it comes to trees with tree decay, the share of decay is important.

8.8 What are the cost trends for using industrial residues?	
EST	No statistics.
GER	Energy and transport costs are rising.
LV	Prime cost grows with increase of technologies and raw material price.
LT	Costs may change due to rising raw material prices and rising salaries and

	energy costs.
SWE	According to statistics from the Swedish Energy Agency, the prices have been on a downward trend from 160 SEK/MWh in 2015 to 147 SEK/MWh in 2017.

8.9 What factors influence the costs for using industrial residues?	
EST	Availability of forest fuels and wages in forestry.
GER	Transport distance.
LV	The cost for using industrial residues is affected by fuel cost and applied transport and chipping technology.
LT	Wood demand and price growth; labour cost growth. Due to increased demand, larger distances may be required, and transportation costs may increase.
SWE	Supply and demand, attach to the sawmill production.

8.10 What are the cost trends for production of processed forest fuel?	
EST	No statistics.
GER	No information.
LV	Prime cost grows with increase of technologies and raw material price.
LT	There is no information.
SWE	According to the Swedish Energy Agency's price statistics, the price of processed wood fuels passed down from 286 SEK/MWh in 2015 to 253 SEK/MWh the last quarter of 2017.

8.11 What factors influence the cost of production of processed forest fuel?	
EST	Transportation, processing equipment, wages in forestry and availability of forest fuel.
GER	No information specific for German framework conditions.
LV	Price is affected by fuel cost and applied transport and chipping technology.
LT	There is no information.

8.12 What are the cost trends for production and harvesting of short-rotation forest fuel?	
EST	No statistics.
GER	Improvement of harvesting techniques lead to decreasing costs.
LV	No commercial scale production takes place.

8.13 What factors influence the costs of production and harvesting of short-rotation forest fuel?	
EST	Wages in forestry, operating costs, transportation and availability of forest fuels
LV	The factors influencing on the cost of production and harvesting of short rotation forest fuel are the transport distances, total area of short rotation coppices, and weather conditions during harvesting season.
LT	The lack of privately owned machinery increases harvesting costs and high cost of collecting biofuel.

8.14 What are the cost trends for using recycled wood-fuel?	
EST	No statistics.
GER	Increasing because energy costs and transportation costs are rising.
LV	Prime cost grows with increase of technologies and raw material price.

8.15 What factors influence the costs of using recycled wood-fuel?	
EST	Availability of forest fuels, operating costs and wages in forestry.
GER	Transport distance - mode of transport
LV	Price is affected by fuel cost and applied transport and chipping technology.