Felling the Golden Goose

The Sustainable Limits of Finland's Biomass Ambitions

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List of abbreviations

CHP	combined heat and power
EU	European Union
PEFC	Programme for Endorsement of Forest Certification
RED	Renewable Energy Directive
TWh	terawatt hours

Foreword

Finland is a forerunner in the use of biomass for energy, and has extensive forest areas that are intensively used. For decades, all efforts have been concentrated on maximising wood production, and Finnish forests contain more woody biomass than ever.

However, even in countries like Finland there are limits to what forests can sustainably supply. Those limits are close to being reached, if they have not already been crossed. The biodiversity of forests is declining and even though effort has been made to address this, this has not been enough to reverse the trend. Increasing demand for biomass for energy will exacerbate this decline even further.

Projections of future wood availability indicate that Finnish forests should be able to provide sufficient to achieve the country's 2020 targets for renewable energy; but beyond 2020 it is difficult to predict whether forests will be able to meet the needs of the Finnish forestry and energy sector *plus* the possible needs of other European countries.

This report sets out to highlight aspects of increasing biomass use that are less discussed but not any less important. Finland is a country with a strong influence on forest policies in the European Union (EU) and a country that likes to portray itself as forerunner in sustainable forest management, so we feel that these issues are relevant to all EU member states.

1. Biomass situation and availability

Biomass from forests is the most important source of renewable energy used in Finland. In 2006, 24 per cent of the energy used in Finland was from renewable sources, most of which (21 per cent of all energy consumption) was from woody biomass. Other renewable energies comprised only three per cent of overall energy consumption.[1] More than half of the woody biomass used for energy consisted of waste liquors and other by- and waste products from forest industries. This makes Finland's renewable energy policy very dependent on the overall development of its paper and pulp industry. More detail about the use of wood for energy is shown in Table 1.

Table 1. Wood fuel consumption in energy generation in Finland, PetaJoules (PJ) [2]

Fuel	2006 (PJ)	2010 (PJ)
Waste liquors and other by- and waste products from forest industries	161	139
Heating and power plants	99	111
Industrial chips	7	7
Forest chips	22	45
Sawdust	13	13
Bark	54	42
Others	3	4
Small scale combustion	55	63
Total	**315**	**312**

Finland's goal is to produce 38 per cent of its energy from renewable energy sources by 2020 as a part of the EU renewable energy target. For the most part, Finland aims to reach this target by increasing the use of wood fuel, especially the use of forest chips (forest residues)[3] in heating and power plants. The aim is to increase the annual consumption of forest chips in heating and power plants from about 5 million m^3 in 2009 to 13.5 million m^3 by 2020,[4] which corresponds to 25 terawatt hours (TWh) of energy.

In addition, Finland aims to increase the use of biofuels in transportation from practically zero TWh to seven TWh per annum by 2020. The main domestic raw material for biofuels is assumed to be forest chips and residues from the forest industry. In the Renewable Energy Action Plan,[5] an overall target of 15 million m^3 of forest chips (including the heat and power and the transport sectors) is given, which indicates an assumption that roughly 1.5 million m^3 of forest chips will go to biofuel production. It is

1 Suomen virallinen tilasto (SVT): Energiankulutus [verkkojulkaisu]. ISSN=1798-6842. 2006, Energian kokonaiskulutus nousi selvästi. Helsinki: Tilastokeskus [viitattu: 3.2.2011] http://stat.fi/til/ekul/2006/index.html .

2 Metsätilastollinen vuosikirja 2011 (Finnish Statistical Yearbook of Forestry 2011).

3 Forest chips consist of logging residues like branches and tree tops, stumps and roots, small diameter stems especially from thinning of young stands and also of timber (see Table 2).

4 Uusiutuvan energian velvoitepaketti-esitys 20.4.2010 http://www.tem.fi/index.phtml?101881_m=98836&s=4265.

5 Uusiutuvan energian velvoitepaketti-esitys 20.4.2010 http://www.tem.fi/index.phtml?101881_m=98836&s=4265.

unlikely that this would be enough to cover a seven TWh increase in biofuel production, and it is unclear how much additional pressure this target will subsequently put on Finnish forests.

Even though forest chips do not yet form a substantial part of the wood fuel used for energy, they are seen as the source of wood fuel with the most potential to increase production. Supplies of other sources of wood fuel are directly linked to the production rate of forest industries (pulp, paper, wood products) and so cannot be influenced by energy policies alone. Also, the Finnish overall energy demand is expected to keep rising which makes reaching the 38 per cent renewable energy target even more challenging.

Use of forest chips for energy has been steadily increasing for the past decade. In 2000 only 0.9 million m^3 of forest chips were used for energy, whereas in 2010 the annual use was already 6.9 million m^3.

Table 2. Consumption of forest chips in 2010[6]

Type of forest chips	1,000 m^3	%
Small diameter stems and trees	2,527	36
Large-sized timber	492	7
Logging residues	2,217	32
Small-scale housing	671	10
Total	**6,909**	**100**

Projections for domestic biomass supply

There have been several projections made by research institutes and consultants, of the availability and possible harvest rates of different types of forest chips. In 2011, the Bio-energy From Forests Programme of the Finnish Forest Research Institute and Technical Research Centre of Finland [7] published a report, comparing five estimates of forest chip availability. These estimates range from circa 14 to 20 million m^3 per year. They mostly show the government's goal of 15 million m^3 per year by 2020 to be feasible, at least technically.

As previously mentioned, it is still unclear how much woody and other categories of biomass would be used by the new bio-refineries to produce transport fuel. The 15 million m^3 per year goal for forest chips already includes a 13.5 million m^3 per year target for forest chips in heating and power plants.

All projections indicate that for the technical potential to be reached, government subsidies will be necessary. One of the projections[8] also highlights potential shortfalls in supply at a regional level, as it is likely that demand will not be evenly spread across the country. Ecological limitations to forest chip harvesting are only considered in one[9] of the projections, which finds nevertheless, that supply will be sufficient.

According to these projections, the available volume of forest chips would comprise of: logging residues; stumps; and small-diameter stems — each making up roughly a third of the total. There is

6 Metsätilastollinen vuosikirja 2011 (Finnish Statistical Yearbook of Forestry 2011).

7 Metsähakkeen hankinta- ja toimituslogistiikan haasteet ja kehittämistarpeet. VTT 2564. http://www.vtt.fi/inf/pdf/tiedotteet/2010/T2564.pdf .

8 Kärhä ym. 2009 in Metsähakkeen hankinta- ja toimituslogistiikan haasteet ja kehittämistarpeet. VTT 2564. http://www.vtt.fi/inf/pdf/tiedotteet/2010/T2564.pdf .

9 Kärhä ym. 2009 in Metsähakkeen hankinta- ja toimituslogistiikan haasteet ja kehittämistarpeet. VTT 2564. http://www.vtt.fi/inf/pdf/tiedotteet/2010/T2564.pdf .

most variation in the estimates of availability of small-diameter wood from young forest stands. The amount available for energy use strongly depends on political subsidies and regulations to ensure that small diameter wood is available for the paper and pulp industry in the first place. In all projections, the availability of forest chips is closely linked with the harvesting rate of roundwood.

Even though the various projections give a fairly reliable picture of forest chip availability in Finland, each is based on a set of underlying assumptions, which can be questioned:

- No imports or exports are considered in the projections. Even though it is politically expedient to refer only to domestic supply, in reality imports of wood fuel are already notable, up to 1.5 million m^3 per year in 2010;[10]
- Projections assume a harvesting rate of roundwood that is based either on the harvesting rates of the past few years, or on increased harvesting rates that match the political goals set in the National Forest Programme 2015. A situation where forest industry production decreases year-on-year (and thus the amount of energy produced from by- and waste products also decreases) has not been considered. This would most likely increase the amount of other renewable energies needed to meet the national renewable energy target;
- When estimating whether volumes of wood fuel will be enough to reach the 38 per cent target, overall energy consumption is always assumed to grow as projected in the National Energy and Climate Strategy (2008). No alternative scenarios, based on an ambitious energy-reduction programme, have been explored.
- This clearly shows that projections of biomass availability can be misleading if projections for the forest industry and the energy sector in general are not taken into account. This makes it harder to arrive at a realistic overview of biomass availability, and can lead to inappropriate policy measures.

> The year 2009 was a good example of how changes in the industry affect biomass use. Energy use of forest chips hit an all time record high (6.1 million m^3) at the same time as production of black liquor (down 26 percent), sawdust and other waste products used for energy, were at the lowest level since 2000. This was due to a hard year in the forest industry in general. Even though more forest chips were used for energy than ever, altogether the share of wood-based energy was below average.

Information about import and export of biomass

Finland imports roughly 10–20 million m^3 of wood each year. Russia is by far the most important country of origin, but Latvia and Estonia also play a major role. The share of imports classified as wood fuel or pellets primarily imported for energy production, has ranged from 0.5 to 1.5 million m^3 per year during 2006–2010.[11] A proportion of the roundwood and chips imported for forest industries is likely to end up as energy as well, but more exact estimates are not available.

Imports of wood to Finland dropped in 2008 because of increased tariffs on all roundwood exports by

10 Puun energiakäyttö 2010. Metsätilastotiedote 16/2011, 3.5.2011 http://www.metla.fi/tiedotteet/metsatilastotiedotteet/2011/puupolttoaine2010.htm

11 Metsätilastollinen vuosikirja 2011 (Finnish Statistical Yearbook of Forestry 2011)

Russia. The quality of wood imported has changed from roundwood to chips, and from softwood more to hardwood — because they attract lower duties.

During the last few years, there have been signs of a slight increase in the import of wood fuels and pellets for the energy sector. However, the trend is still not clear and goes against the obvious trend of growing demand for wood fuels from Finnish forests.[12] Imports of pellets in 2011 were 14,000 tonnes whereas before 2008 there were practically no imports in the sector. Pellets are mostly (90 per cent) imported from Russia.[13] Fuel wood imports reached a total of 1.5 million m^3 in 2010[14], but have since retreated back to a level of 0.2 million m^3 per year.[15]

Even though imports of fuel wood have been growing, Finland has based its targets for wood fuel on domestic supply alone. Nonetheless, it is obvious that wood fuel will be imported from Russia and other countries as long as the transportation distances are manageable and costs lower than in Finland.

Exports of fuel wood from Finland are very small, at only 10,000–20,000 m^3 per year. Exports of pellets have steadily increased during the past decade, but still only amount to about 150,000 tonnes per year. Pellets from Finland are mainly exported to Sweden and Denmark.[16]

Given all of this, it is hard to get a realistic overview of biomass availability.

12 http://www.metla.fi/julkaisut/workingpapers/2010/mwp155.htm.

13 http://www.metla.fi/metinfo/tilasto/julkaisut/mtt/2012/puupelletit11.pdf.

14 Puun energiakäyttö 2010. Metsätilastotiedote 16/2011, 3.5.2011
http://www.metla.fi/tiedotteet/metsatilastotiedotteet/2011/puupolttoaine2010.htm

15 Metsätilastollinen vuosikirja 2011 (Finnish Statistical Yearbook of Forestry 2011).

16 http://www.metla.fi/metinfo/tilasto/julkaisut/mtt/2012/puupelletit11.pdf.

2. Biomass sustainability criteria

Finland has no national scheme of sustainability criteria for biomass or for biofuels. The Renewable Energy Directive (RED) and its sustainability criteria for biofuels have been implemented with a law that came into force in January 2011.[17] With reference to sustainability criteria, the law simply states that biofuels and their raw materials should fulfil the sustainability criteria described in the Directive. Compliance with measures described in the criteria must also be ensured.

Legislation to implement the sustainability criteria in RED (articles 17–19) has been in preparation since the beginning of 2011, but it is unclear when it will come into force and what its exact content will be. However, it seems Finland believes it crucial to ensure that the interpretation of so called no-go areas (article 17(3)) and land use change (article 17(4)) will not bring any new requirements for forest management.

Thus, until the new law on sustainability criteria comes into force even the sustainability criteria for biofuels will remain poorly implemented, and no national schemes will have been developed. Unsurprisingly, there have also been no suggestions of, or any official reference to, the need for separate sustainability criteria for biomass.

In fact, Finland has actively and strongly opposed any sustainability criteria from the Commission for solid and gaseous biomass. Finland has, for example, argued that such sustainability criteria would bring no additional value but only increase the administrative burden on biomass production. They also argue that biomass for energy should have no specific criteria, but that sustainability should instead be ensured through the implementation of sustainable forest management, for which there are already many policy mechanisms in place. According to Finland, in forestry at least, sustainability is already under control.[18]

If there will be binding sustainability criteria for biomass, Finland would like to see the criteria match existing forest certification schemes like the Programme for Endorsement of Forest Certification (PEFC). This is important as 95 per cent of Finnish forest cover is already certified. So far PEFC and other forest management schemes do not match with even the biofuels sustainability criteria so the certification schemes would need to adopt major changes to be able to deal with the emissions balance of, for example, biofuels and biomass production.

In summary, the debate concerning sustainability criteria for biomass or biofuel has focused more on interpreting the requirements of the Directive as specifically as possible, rather than trying to come up with national initiatives to guarantee sustainability. Even so, it is still unclear what the interpretation will be and what the possible law on sustainability criteria for biofuels will look like.

17 http://www.finlex.fi/fi/esitykset/he/2010/20100197 (in Finnish)

18 Letter to DG Energy 9 Feb 2012: Finland's input to the discussion on the need for sustainability criteria for solid and gaseous biomass.

3. Analysis and problems with sustainability

Problems with sustainability: biodiversity

Energy wood harvesting has been the subject of many research projects in Finland during the past decade. Most research has focused on technology and the economics of harvesting, and effects on forest health. There has been less research on the biodiversity impacts of energy wood harvesting, and in particular the impact on biodiversity of stump removal are poorly understood.

Nonetheless, enough research exists to give an idea of the effects on forest and soil biodiversity. For example, existing Finnish and Scandinavian research[19] [20] [21] [22] has indicated the following concerns:

- The lack of dead wood is the single most important reason for forest dwelling species to become endangered in Finland. If the amount of dead wood in managed forests should further decrease as a result of energy wood harvesting, this will result in increasing threats;
- Many endangered species are particularly dependent on coarse dead wood, but as dead wood has become scarcer in commercial forests, man-made dead wood like logging residues and stumps have come to provide an important habitat for endangered species;
- Removal of logging residues affects the temperature and moisture conditions in the soil; the amount of biomass available as nutrient source; soil acidity; and by these means, affects the soil fauna;
- The long-term effects of the removal of organic substances on soil fauna, structure and function of forest soils, are still far too poorly understood;
- Stumps serve as a breeding ground and habitat, in particular for many insects. Stump harvesting might result in harvesting of these populations.

Research suggests that in particular stump removal; possible intensification of forestry; and increased use of currently unexploited areas due to energy wood harvesting, have the potentially biggest negative impacts on forest biodiversity — which is already in decline.

Problems with sustainability: climate

A recent study[23] commissioned by the Ministry of Environment looked at the emission reductions attributable to energy wood from Finnish forests. It found that the reduction is likely to be much smaller than so far assumed, if all changes in carbon stocks are accounted for.

Increasing the energy wood harvest will lead to a significant reduction in soil carbon stocks during the next decades, when action for climate change mitigation is most crucial. The research estimates that if the harvesting of energy wood rises to meet current targets, the carbon sinks of forests will decrease by 6.2 million tonnes of CO_2 a year by 2020.

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19 Laitila, J., Asikainen, A. & Anttila, P. 2008. 1. Energiapuuvarat. Ss. 6-12 julkaisussa: Kuusinen, M., Ilvesniemi, H. (toim.) 2008. Energiapuun korjuun ympäristövaikutukset, tutkimusraportti. Tapion ja Metlan julkaisuja. [Verkkodokumentti]. Saatavissa www.metsavastaa.net/energiapuu/raportti.

20 Bioenergian tuotannon uudet haasteet Suomessa ja niiden ympäristönäkökohdat. Nykytilakatsaus Suomen ympäristökeskuksen raportteja 11 | 2007.

21 http://www.tapio.fi/files/tapio/Eng%20sivut/preserving_biodiversity_in_forest_bioenergy_harvest.pdf

22 Jonsell, M. & Hansson, J. 2011. Logs and stumps in clearcuts support similar saproxylic beetle diversity: implications for bioenergy harvest. Silva Fennica 45(5).

23 http://www.ymparisto.fi/default.asp?contentid=374919&lan=fi&clan=fi.

If the targets for wood for energy-wood harvest were met, the amount of fossil fuel that could be replaced is equivalent to annual emissions of 7.6–10.7 million tonnes of CO_2 (depending on what kinds of fossil fuels would be replaced). But when the reductions in forest sinks due to energy wood harvesting are taken into account, the net emission reductions would only be 1.4–4.5 million tonnes of CO_2. In reality, the emission reductions from woody biomass are much less than the commonly assumed 100 per cent, once the overall impacts are considered. It is also likely that the removal of nutrients due to harvesting logging residues and thinning wood will have a negative impact on the growth of the forests — thereby decreasing the forests' ability to store carbon in the future.

Just how far carbons stocks will be reduced depends on the type of woody biomass used for energy. Using small-sized logging residues that otherwise decay in forests quite quickly, results in smaller and shorter-lasting reductions in the carbon stocks; whereas stump harvesting creates a reduction in the carbon stocks of almost twice the size and duration. Using wood that would have otherwise been used by the forest industry, however, would create no additional reductions in the carbon stock.

It also essential to note that two key factors play a significant role when estimating the emission reductions that can be achieved by wood energy: whether wood is actually replacing (not supplementing) fossil fuel consumption; and what kind of fossil fuel is being replaced.

Problems with sustainability: inefficient use of biomass

Forest chips are mostly used in heating and power plants, if not used directly by the forest industry. Woody biomass is the energy source with the most potential to replace fossil fuels (such as coal and peat) in combined heat and power (CHP) plants and in smaller heat-producing plants in Finland. The energy conversion efficiency of CHP plants is typically 85 per cent or more. CHP plants are thus the most efficient way to produce energy from wood.[24]

Finland has encouraged energy production from renewable sources through different kinds of subsidies. There is a feed-in tariff system in place for renewable energy, and previously a fixed subsidy was available for electricity production from wind, wood chips, biogas and hydropower. There are also substantial subsidies for renewable energy production investments. Even though these subsidies are vital to advance renewable energy production, it remains problematic that they do not come with strict requirements for efficiency attached, especially in the case of biomass use.

According to RED, the contribution towards the targets by "biofuels produced from wastes, residues, non-food cellulosic material, and ligno-cellulosic material shall be considered to be twice that made by other biofuels" (article 21.2). This has lead to an interpretation that all biofuels produced out of wood in Finland can be double-counted towards the renewable energy target for transport fuels.

Encouraged by this double-counting possibility, Finland has set an ambitious goal of a 20 per cent share of biofuels in transport by 2020, even though at the moment the share of biofuels is practically non-existent. It is hoped that the goal can be reached through new investments in so-called bio-refineries that would produce transport fuels from logging residues, stumps, by-products of the forest industry and other woody biomass.

This 20 per cent target is especially problematic during the initial years, at least until 2015. It is proposed that the share of biofuels will increase gradually, even though new investment in bio-refineries is

24 Arvio biomassan pitkän aikavälin hyödyntämismahdollisuuksista Suomessa. Asiantuntijatyöryhmän raportti 12.2.2007.

unlikely be effective before 2015. In the proposed law[25] to promote use of biofuels in transportation, it is admitted that targets would initially have to be met with imported biofuels (which in practice means palm oil).

The woody biomass used for biofuel production can hardly be defined as a waste or by-product of the industry since it is mostly biomass that previously was left in the forest and is now separately harvested for energy use. Since, even in Finland, woody biomass is not a limitless resource, it should be used in the most efficient manner and where it is most needed to replace fossil fuels. Converting wood to transport fuel is likely going to be much less energy efficient than using the wood in CHP plants.

The transport sector in Finland could be built on biofuels from actual waste products and on electrical vehicles. But the double-counting incentive created by RED will lead to an inefficient use of biomass.

Why sustainability criteria are needed

Currently, the only regulations widely used and accepted in this area are the 'Recommendations for Energy Wood Harvesting'[26] by Forestry Research Centre Tapio. They also serve as a basis for certification schemes like the PEFC in Finland. First issued in 2005, they were most recently updated in 2009.

The 2009 update, however, did not reflect recent developments in the understanding of environmental impacts. Even a special report[27] issued by Tapio and the Finnish Forest Research Institute, suggesting improvements to the recommendations from an environmental perspective, was not incorporated. It must be noted that the recommendations, as such, are voluntary and include no verification system.

Despite the growing volume of research available, it is often argued that there is not yet enough knowledge and understanding of the environmental consequences of energy wood harvesting. Wider assessments of environmental impacts, like the 2008 report by Tapio and Metla, have also not taken into consideration the possible impacts of the current targets for energy wood harvesting, but are still based on the lower targets set in 2008.

When releasing the National Renewable Energy Action Plan for Finland in 2010, the government promised that it would carry out an environmental impact assessment of the new targets for energy wood extraction. But a research programme to assess the impacts and risks of the growing use of renewable energies was only started in 2012.[28] Such an impact assessment is still much needed but any possible recommendations and outcomes are only expected by the end 2013. This will be too late to change the policies already put in place to reach the 2020 renewables target. Sadly, the research project will only look at the impacts of the current policies and targets so it will not be able to give direct recommendations for possible future policies.

So, the claimed lack of knowledge on the environmental (and forest health and water protection) impacts of energy wood harvesting has not led to limitations in energy wood harvesting targets. In fact, it has been used to justify limitations to environmental regulation while energy wood harvesting continues to grow.

A lack of sustainability criteria for biomass and an assumption there is no ecological limitation to the amount of biomass that is available, combined with an absence of binding targets for energy saving,

25 http://www.tem.fi/files/27834/HEluonnos_jakeluvelvoite_160910_korj.pdf

26 http://www.tapio.fi/files/tapio/Aineistopankki/Energiapuusuositukset_verkkoon.pdf

27 Kuusinen, M., Ilvesniemi, H. (toim.) 2008. Energiapuun korjuun ympäristövaikutukset, tutkimusraportti. Tapion ja Metlan julkaisuja. [Verkkodokumentti]. Saatavissa www.metsavastaa.net/energiapuu/raportti.

28 http://www.ymparisto.fi/default.asp?contentid=408832&lan=fi

has led to energy policies that have as their main priority simply the fulfilment of renewable energy goals — not to mitigate climate change in a sustainable way.

This is clearly illustrated by the fact that none of the governmental strategies, proposed laws or papers to promote the use of renewable energies actually give an estimate of the actual emission reductions that would be delivered. New research on the real climate benefits of energy wood, when shrinking of the soil carbon stocks are considered, clearly show that the benefits of woody biomass need to be more carefully analysed, and guaranteed through meaningful sustainability criteria.

The underlying tone of the debate about sustainability criteria for biofuels and biomass (apparent in the report "Sustainability criteria of the EU's renewable energy Directive" (see above)) is that first and foremost they are designed to guarantee sustainability of biofuels produced outside the EU. They are not appropriate for European conditions. Sustainability issues (in particular biomass production in Europe) clearly need to be highlighted more by the Commission and sustainability guidelines must be drafted that specifically address European circumstances.

One final aspect of sustainability is developments beyond 2020. So far, the scenarios for wood availability for energy in Finland presume a target of 13.5 million m^3 per year to be feasible, with enough wood available to be able to choose between different types of wood to reach the targets. But many scenarios show this target to be close to the maximum amount that can be sustainably harvested. This all greatly depends on the development of the forest industry in Finland. At the same time, with most investments and incentives focussed on one source of energy — the energy use of biomass — the capacity-building of other renewable energy sources is lagging behind. How Finland will move beyond the 38 per cent target for renewable energy remains an open question.

4. Key recommendations for policy makers

We recommend that policy makers, as an initial response to the concerns raised in this paper, urgently take action on the following issues:

- **Binding targets and comprehensive measures for energy saving and efficiency need to be ensured.** The proposed Directive on energy efficiency provides a good tool for Finland and the rest of the EU to implement energy-saving measures. It is essential to lower overall energy consumption in order to maintain the use of biomass within the limits of sustainable biomass supply, and to ensure biomass will substitute, not supplement, non-renewable energy sources. The long-term targets for biomass use in Finland should be re-evaluated in relation to the overall energy consumption levels in the upcoming revision of Finland's Climate and Energy Strategy.

- **The Finnish government should strongly support the development of binding and ambitious sustainability criteria for biomass in the EU.** As one of the biggest users of biomass for energy, Finland should lead the way in implementing such criteria on a national level, rather than make efforts to delay them. Finland should push for sustainability criteria that: minimise the carbon debt arising from increasing biomass use; ensure efficient use of biomass; and exclude biomass produced in areas important to biodiversity.

- **Only efficient uses of biomass for energy should be subsidised.** Burning biomass always creates both heat and power. Both should be fully utilised when using biomass, a scarce resource, for energy production. In Finland, subsidies for electricity production from renewable sources come with no requirements relating to the efficiency of biomass burning. The government is also investing in biofuel production from wood — where a lot of energy can be lost in the transformation process.

- **The limits of biomass use need to be recognised and addressed.** Targets for increasing the use of biomass mostly rely on biomass resources that were previously left in situ, such as stumps and harvesting residues. So it is obvious that biomass use for energy will increase the pressure on forests. Yet, in Finland's National Forest Programme, targets for wood removals only consider roundwood. There is no evaluation of the overall impact, or the limits of sustainability, of combined roundwood and energy wood removal. The forests in Finland cannot sustainably supply much more than what is already used. The demand for energy wood should not push wood removals beyond these limits and that is why the targets for wood energy use should be set in relation to the overall targets on wood removals.

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