Are Forests the New Coal ?

A Global Threat Map of Biomass Energy Development

There is a new and growing threat to the world's forests, people and climate – the biomass energy industry. Wood pellets are the major commodity feeding this industry.
This report outlines the evolution of this threat and maps its frightening expansion in scale and global extent now and over the next ten years.

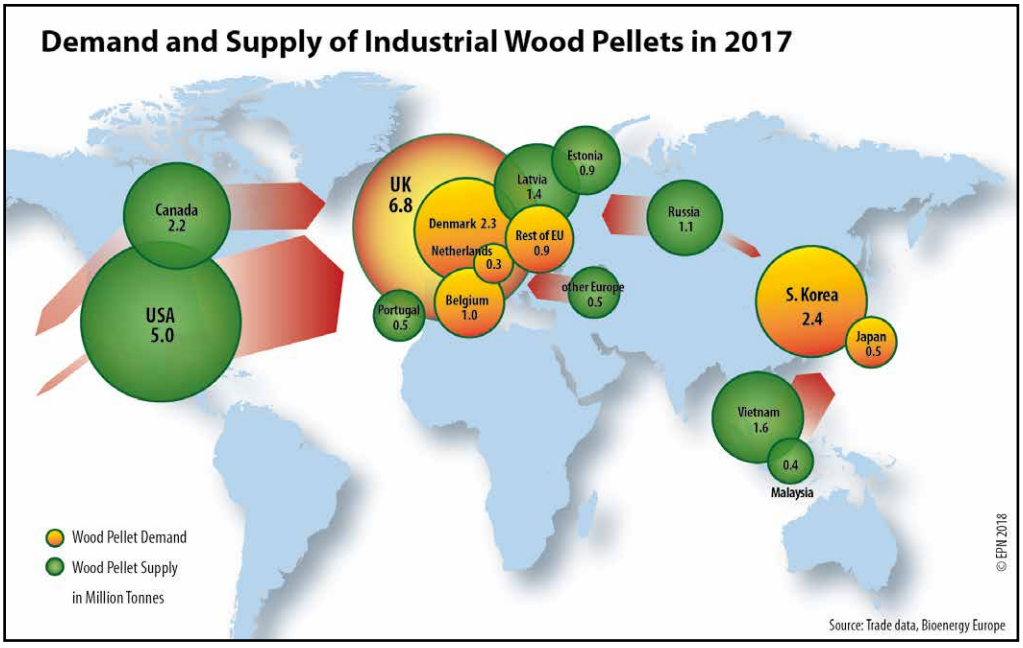
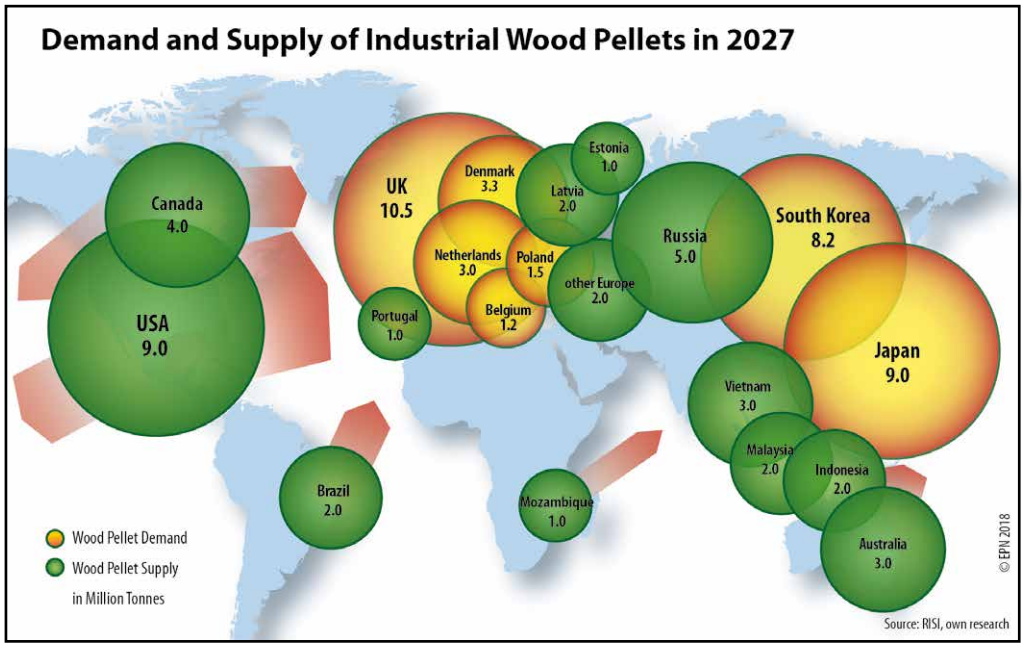


Figure 1:
Demand for industrial wood pellets exceeded 14 million tonnes in 2017.
In the next decade, it is expected to more than double to over 36 million tonnes.
The biggest increases are expected in Europe, Japan and South Korea. [1]



1 The maps show the major exports and imports of industrial wood pellets. This does not include pellets produced and consumed in the same country, nor for domestic heating. Pellets can be made from agricultural by-products like straw or palm kernel shells, but forest biomass dominates in both supply and demand.

2017 data are based on available trade statistics. Where 2016 data was used, figures were adapted according to changes in production and consumption facilities.

2027 projections are based on information about planned pellet mills and co-firing facilities and assumptions on the development of national policies regarding bioenergy. Figures were cross-checked against projections by RISI, Future-Metrics or IEA. Different datasets may use different approaches, but they all concur that the use of wood pellets for the production of energy and heat will more than double in the coming ten years.

A briefing by the Forest, Climate and Biomass Energy working group of the EPN

Environmental Paper Network

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Key Findings

1. Global supply of and demand for forest biomass is predicted to increase more than 250 % over the next decade, having already doubled in the last ten years.

2. Biomass energy, predominantly forest biomass, dominates 'renewable' energy production, dwarfing wind and solar and undermining their prospects by diverting subsidies that should be applied to such genuinely low emissions technologies.

3. Countries in Asia are making the same mistakes that European countries made in encouraging large scale biomass burning for energy production. Japan and South Korea are now heading down the same wrong road that faulty European Union policies enabled, namely subsidising power generation from forest biomass and failing to count smokestack carbon emissions resulting from wood burning.

4. The majority of feedstock for the increasing pellet market will be supplied directly from forests, inevitably entrenching and expanding logging at higher rates over greater areas. This is in stark contrast to findings in the latest Intergovernmental Panel on Climate Change Special Report regarding the urgency of protecting and expanding forests in the near term as critical for avoiding the worst impacts of climate change.

5. Growth in the industry is likely to occur by expanding supply from tropical, temperate and boreal forests in developing and developed countries, thereby posing an escalating global threat to natural forest ecosystems including those that are mega-diverse or carbon rich.

Introduction

This report summarises the scale and global extent of a new and growing threat to the world's forests, people and climate – the biomass energy industry. A global network of civil society organisations came together to map out the threat that this industry poses. We have researched and collated the supply and demand dynamics to date and over the coming decade.

The acceleration of large scale burning of wood in facilities for energy production is the focus of our concern. We are not talking about traditional biomass, as used for heating and cooking in many rural areas of the global South, nor are we focused here on home heating based on community-level wood supply.

Our focus is on the establishment and expansion of additional damaging forms of bioenergy power: stand-alone generating facilities that burn wood chips or pellets to create electricity or combined heat and power (CHP), and conventional (usually coal) power plants converted to burn a mixture of coal and wood pellets (known as co-firing).

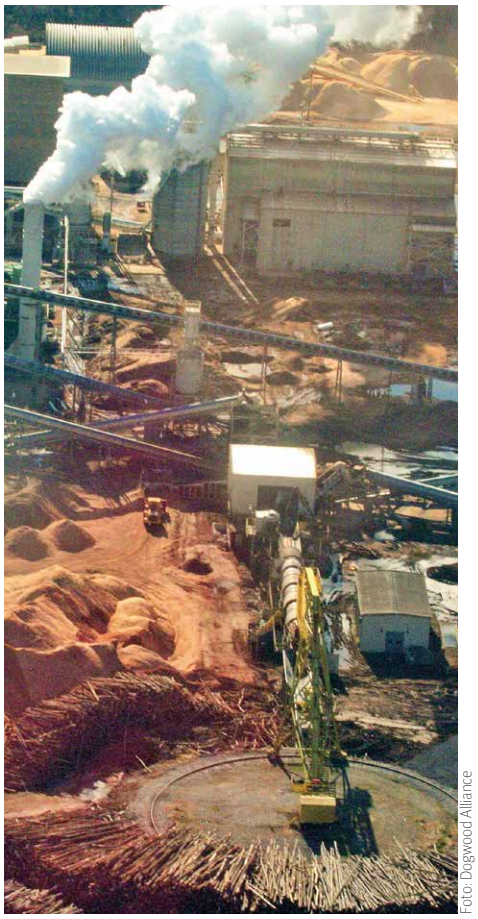


Foto: Dogwood Alliance

Biomass Delusion

a joint position statement

It is important to consider the findings of this report in conjunction with the underlying problems associated with production of biomass energy at large scale, especially its highly emissive nature that threatens to exacerbate climate change whilst promising to provide a remedy.

The harm inflicted by biomass industry is outlined in the recently released #BiomassDelusion position statement endorsed by over 130 non-government organisations globally.

The statement outlines that:

Large- scale burning of forest biomass for energy

harms the climate
- it is not low carbon
- it is encouraged by flawe carbon accounting

harms forests
- it threatens biodiversity and climate resilience
- it undermines the climate mitigation potential of forests

harms people
- it undermines community rights and interests
- it harms human health and well-being

harms the clean energy transition
- it provides a life-line for burning coal for energy production
- it pulls investment away from other renewables

The signatory organisations are not seeking 'improvements' in large-scale biomass energy through certification. Rather, we believe that we must move beyond burning forest biomass to effectively address climate change.

1. The Burning Issue

The biggest share of renewable energy comes from forests – and its use is increasing

When asked about renewable energy, most people think of wind and solar. However, biomass power accounts for a greater share of energy production than these two 'true' renewables (see Figure 2). Solid biofuels [2] provide for 36 % of renewable energy (more than the combined share of wind, solar, tidal and geothermal energy).[3] Burning trees for biomass power is misleadingly classified by its supporters as a 'clean' and 'carbon-neutral' source of energy, when in fact biomass power creates major air pollution problems at the site of combustion[4], and exacerbates climate change through very high per-megawatt-hour releases of CO_2 and other greenhouse gases.[5]

The use of forest biomass for electricity and heat production has doubled globally over the past decade (see Figure 3), from 30 Gigawatt in 2007 to over 60 GW in 2017. The biggest percentage increases were in Korea, Poland and the UK.[6]

Ironically, these dramatic increases in bioenergy use are predominantly driven by incentives intended to help utilities reduce greenhouse gas emissions, mostly by substituting wood for coal. Yet burning wood to generate energy emits even more carbon, on a per-unit-of-energy basis, than burning coal,[7] while increasing harvest rates in forests depletes their capacity to act as sinks and degrades the world's carbon stocks.

Consequently, biomass power represents a 'doubly false' solution – not only does it fail as a low-carbon energy source, but also the carbon sequestration function of forests is lost if trees are cut down to fuel energy demand. On top of this are the high levels of embedded emissions in pellet manufacture and transport.

In addition to the climate impacts, biomass burning exacerbates the biodiversity crisis because of the intensity of harvests designated for energy use (described below).

Biomass burning also adds to social conflict since in many locations it threatens the rights and livelihoods of indigenous and tribal peoples and local communities. Biomass burning can also deepen commercial conflicts, competing for raw materials with forest-sector businesses that rely on sawn timber and wood fiber.

Fuel shares in 2015 OECD total primary energy supply

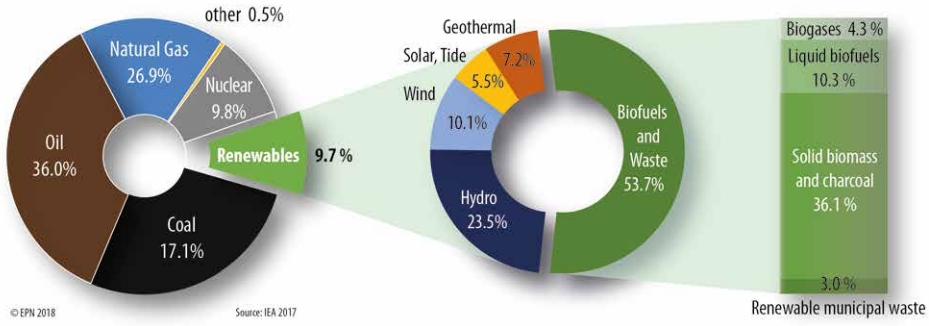
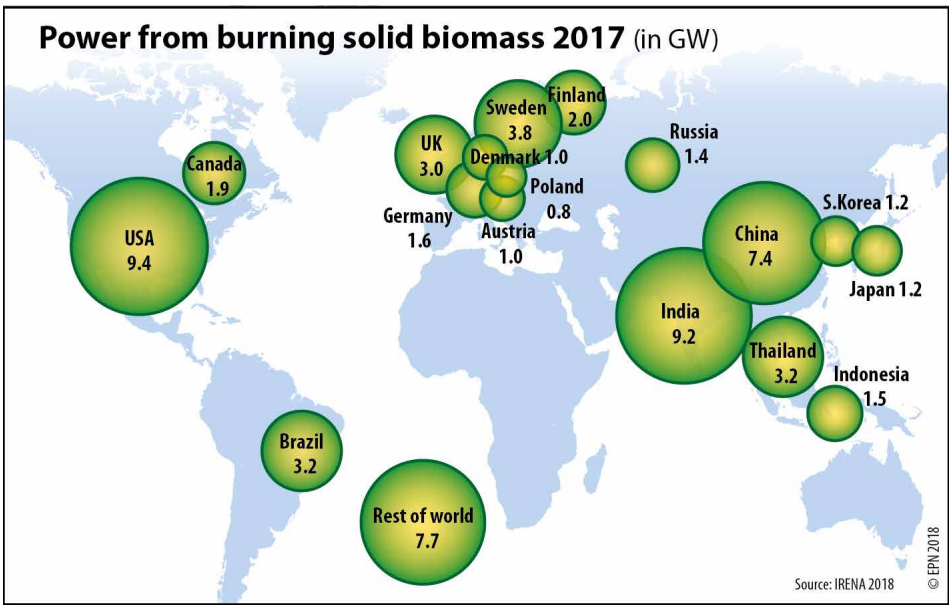


Figure 2: In industrialised countries, more than half of all renewable energy is derived from agricultural crops and forests

Figure 3: Globally, the use of forest biomass for electricity and heat production has doubled over the past decade.



2 Solid biofuels mainly consist of forest biomass, but also include agricultural by-products like straw, palm kernel shells or bagasse, which remains when sugar has been extracted from sugar cane.

3 IEA 2017: Renewables Informations

4 Mike Holland 2018: Covered in smoke: why burning biomass threatens European health, fern.org/report/biomassandhealth

5 F. Cherubini et al. 2011: CO2 emissions from biomass combustion for bioenergy: atmospheric decay and contribution to global warming, doi.org/10.1111/j.1757-1707.2011.01102.x

6 IRENA 2018: Renewable Capacity Statistics

7 John Sterman et.al. 2018: Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, Environmental Research Letters, http://iopscience.iop.org/article/10.1088/1748-9326/aaa512/meta

Production, trade and consumption of forest biomass

As noted above, we are less concerned with issues of traditional biomass, or the use of biomass for energy generation within the forest products sector. Many pulp mills burn wastes from chemical pulp production (black liquor) in biomass power plants.[10] By contrast, new bioenergy fuel demand is increasingly met with feedstocks derived directly from forests, in the form of wood chips or wood pellets. The fastest growing market segment of all is wood pellets traded internationally.

International trade in wood chips is in the millions of metric tonnes annually, but official figures don't make a difference between pulp, composite wood products or energy feedstocks. Wood chips dedicated to energy generation have until recently been used primarily in small to medium scale energy applications, such as Combined Heat and Power (CHP) or district heating plants.

Their feedstocks are usually obtained regionally, especially if they are not near to a port.

However, the number of larger energy production facilities (>100 MW) that rely heavily on imported wood chips is increasing.

Understanding 'residue'

Large-scale forest biomass energy industry claims to be based on wood residues. The popularly understood concept of wood residues is that they accrue in sawmills, where less than half of the timber processed ends up in long-lived boards and beams.[11] The 'sawmill residues' are either burned on site (for example, in wood-drying kilns), used to produce fibreboard or other medium life composite wood products, or processed to short lived wood chips or pellets.

Yet the scale of biomass energy production dictates that the volumes of wood required cannot be supplied from such sawmill wastes. **Enormous volumes are taken direct from the forest as whole logs, limbs, tops or stumps.**

All this, even the whole trees, is defined as residues based on the lesser merchantable value per unit weight or volume when compared to the few high quality saw-logs generated by the same logging operation.

The so called 'residue' stream can often comprise the majority of the product arising from a logging operation. The income generated by high-intensity harvests based on *quantity* criteria may make more logging operations financially viable, as compared to those operations constrained to take high *quality* wood alone.

In places where the community is struggling to retain natural forests the advent of such a lucrative, incentives-based 'residue' trade can drive further logging incursions and promote clearcutting as a logging method.

Where logging is an accepted use at a lower intensity, the advent of high intensity harvests for biomass may lead to serious depletion of nutrients in the ecosystem and impede regeneration. Subsidised biomass is also implicated in undermining other forest product sectors.

10 The Environmental Paper Network remains concerned about the expansion of pulping capacity and its impacts on forests and climate

11 Sally Krigstin, Kaho Hayashi, Jacek Tchórzewski, Suzanne Wetzel (2012): Current inventory and modelling of sawmill residues in Eastern Canada, The Forestry Chronicle, 88(5), https://doi.org/10.5558/tfc2012-116

Firewood - a problem not only in the global South

About 43 % of global renewable energy consumption is attributed to "traditional biomass", i.e. the widespread non-commercial use of firewood for residential heating and cooking in developing countries.[8]

In developed countries the share of wood going directly to energy is also large. In the EU the non-commercial local use of firewood amounts to 129 million m³ per year (roughly 30 % of the annual harvest).[9] Trade is basically limited to neighbouring countries.

8 IEA 2017: World Energy Outlook 2017, https://www.iea.org/weo2017/

9 Nabuurs, G.J.; Arets, E.J.M.M.; Lesschen, J.P.; Schelhaas, M.J. (2018): Effects of the EU-LULUCF regulation on the use of biomass for bio-energy, https://www.wur.nl/en/Publication-details.htm?publicationId=publication-way-353338333338

Foto: Sini Eräjää

Charcoal

The industrial use of charcoal features high in Brazil, where it is one of the main sources of energy for the production of crude iron. Over the last six years, around 5 million tonnes of charcoal were consumed annually.[12]

Today, the wood used to produce charcoal mainly comes from plantations (approximately 90 % eucalyptus), which have been established on sites previously comprised of native forests and other natural ecosystems. Such conversion poses a serious range of social and environmental problems, in addition to the emissive impacts of charcoal use in industry.

12 Brazilian Institute of Geography and Statistics (IBGE), https://sidra.ibge.gov.br/pesquisa/pevs/quadros/brasil/2017

2. The Biomass Delusion

Wood pellet production and trade are escalating dramatically

Demand for industrial pellets is expected to more than double in the next decade to over 36 million tonnes. While increases in Europe may reach a maximum by 2020, major growth is expected in South Korea, Japan, and potentially China. This is an extremely worrying trend, as the implementation of policies to increase this form of energy production is a misguided emulation of the policies in Europe. Industry analysts are discussing the rapidly growing demand in Asia and posing the question, will there be enough biomass supply to meet it? [13]

At the same time, **forecasts for the heating pellet sector in Europe and North America project a continuous increase** of nearly 1 million tonnes per year for the next ten years. The market is expected to grow at approximately the same rate in all countries, reaching 26 million tonnes in 2027. [14]

This increased demand will have considerable consequences for the world's forests. More than 60 million tonnes of pellets cannot and will not be produced from sawmill residues and post-consumer waste. Increasing the demand for forest biomass will further increase the area subject to logging and the intensity of that logging, thus increasing the degradation of natural forest ecosystems. In many cases this will escalate the conversion of intact forest landscapes into monoculture tree plantations or result in deforestation.

Current situation

The international trade in forest biomass for energy is dominated by wood pellets. Production has more than quadrupled in the last ten years, reaching 29 million tons in 2016,[15] while production capacity increased to 55 million tonnes.[16] Nearly 60 % of production is exported, primarily by the nine countries shown as 'Suppliers' in figure 1.

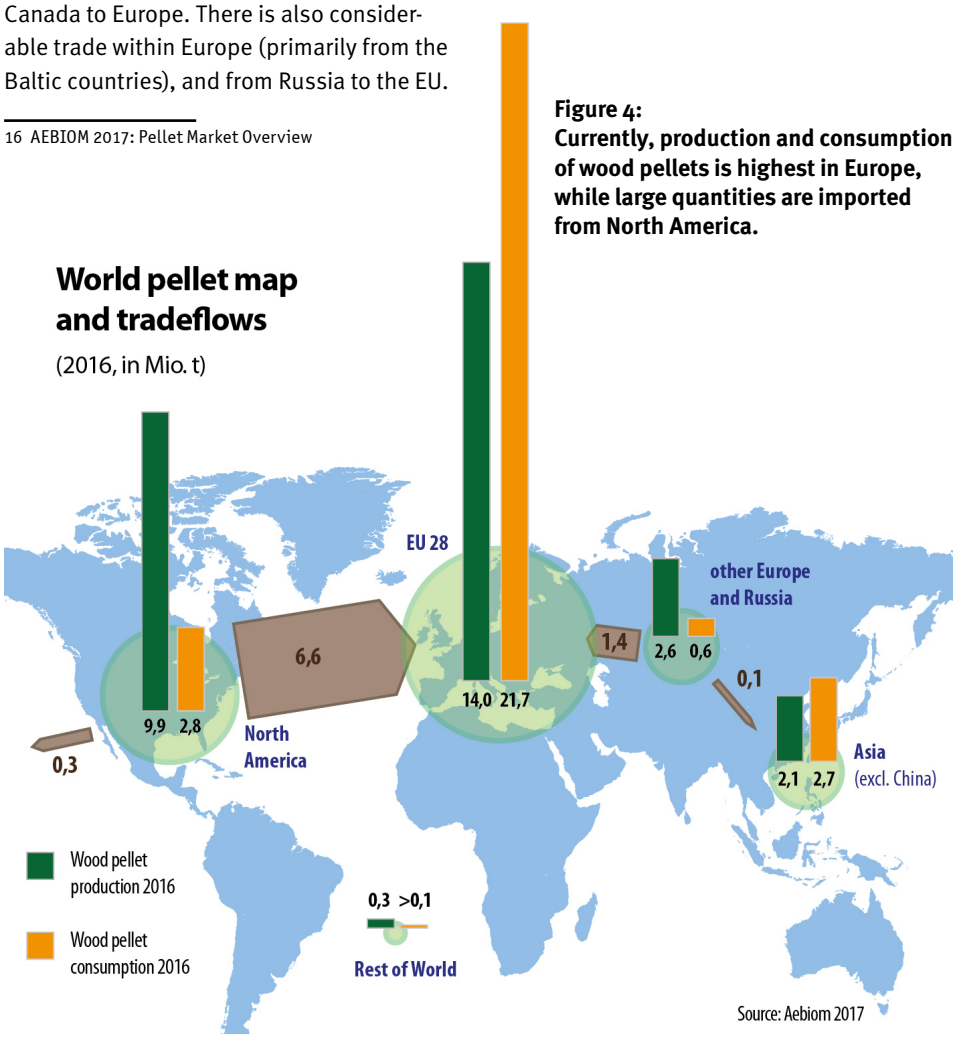
International standard-setting bodies have developed consistent product specifications – qualities like moisture, energy density or particle size – establishing pellets as a commodity that can be traded globally.

As shown in figure 4, Europe is still the world's biggest producer of wood pellets, accounting for 49 % of global production. North America follows behind with 35 %. Despite the high level of production in Europe, demand outstrips supply, and thus Europe is also the largest net importer of biomass. The global pellet trade is dominated at present by exports from the US and Canada to Europe. There is also considerable trade within Europe (primarily from the Baltic countries), and from Russia to the EU.

In North America, pellet production for export to Europe is devastating natural ecosystems. Local consumption of wood pellets is almost entirely for home heating ('pellet stoves').

The situation in Europe differs from country to country. In Italy, Germany and Scandinavia, pellets are primarily used for heating, while industrial use in energy production dominates in the UK, Denmark and Belgium. In the Netherlands, co-firing of wood pellets in coal plants started in 2017 and is expected to increase from 2018 on. In France, a conversion to co-firing is planned to prevent the closure of the remaining coal power plants after the so-called coal 'phase-out' that is scheduled for 2022.

Figure 4:
Currently, production and consumption of wood pellets is highest in Europe, while large quantities are imported from North America.



16 AEBIOM 2017: Pellet Market Overview

13 www.hawkinswright.com/news-and-events/blog/post/hawkins-wright-blog/2018/07/26/can-wood-pellet-supply-keep-up-with-asian-demand

14 Canadian Biomass: Global pellet market outlook in 2018, www.canadianbiomassmagazine.ca/pellets/increasing-demand-6705; Hawkins-Wright: 2018 pellet market outlook, www.hawkinswright.com/news-and-events/blog/post/hawkins-wright-blog/2018/01/17/2018-pellet-market-outlook

15 Industrial and domestic pellets; AEBIOM 2017: Pellet Market Overview

Strangely enough, the main demand driver in Europe is climate policy, specifically a flawed "Renewable Energy Directive" (RED) that classifies forest biomass as a renewable energy source alongside wind and solar. International policy and deeply flawed carbon accounting under the Kyoto Protocol create a false impression of carbon neutrality for energy from forest biomass, thus putting it in direct competition with energy sources, such as wind and solar, that truly are carbon neutral.

From a utility's perspective, it is far easier to co-fire wood with coal, or to convert coal-fired power generators to burn forest biomass, than it is to embark on the path of converting its generating capacity to true, low-carbon renewable power.

In Asia, Vietnam has become the biggest exporter of pellets in the region, primarily supplying South Korea and Japan. These countries are also supplied from Canada, the USA and Russia. Both South Korea and Japan have copied the EU example – and the policy flaws associated with the RED and the Kyoto Protocol – by implementing policies that encourage the use of forest biomass. As in Europe, the Korean and Japanese governments have provided a variety of subsidies to the biomass power industry – subsidies that, in many cases, are not being made available for wind and solar projects.

Foto: Daniel Heighton

Forest biomass is emissive, not carbon neutral

Burning biomass involves combustion of organic matter and emits CO_2 to the atmosphere, just as burning fossil fuels does. Per unit of energy, burning biomass emits even more CO_2 than burning fossil fuels. [17]

Two main arguments are used to claim that power from forest biomass is carbon neutral, or zero emissions:

- Tree or forest regrowth will subsequently sequester an equivalent of carbon as initially emitted, thus netting out to zero emissions.
- If forest biomass comprises wastes or residues that would otherwise decompose, then emissions from burning are equivalent to those that would have happened anyway, and not additional.

There are significant problems with these assumptions.

Burning emits carbon instantaneously, whereas decomposition of residues is slow. Forest regrowth will take decades to centuries. Meanwhile that carbon is in the atmosphere causing further warming, and this occurs regardless of whether forest management is 'sustainable'. [18]

Yet time is of the essence when addressing climate change. To meet the targets of the Paris agreement, in particular to make our best efforts to limit levels of warming to 1.5C, the carbon debt generated by burning forest biomass needs to be recovered rapidly. Instead, where full regrowth occurs, it would be many decades before net zero is reached, potentially after 2100. [19]

Further, there is no guarantee of full regrowth and no one is checking up on it. Occurrences such as land use change and deforestation, or substitution of monoculture plantations for natural forests all deplete carbon in perpetuity and are not unusual. Serious loss of soil carbon also occurs as an effect of logging. Intensified logging regimes for biomass supply often mean reduced rotation times such that the forest never regrows to previous levels of carbon stock.

Finally, any logging for biomass reduces the amount of CO_2 that forests would have sequestered otherwise, and foregone CO_2 sequestration has the same impact on the climate as increased CO_2 emissions. [20]

17 Duncan Brack 2017: Woody Biomass for Power and Heat, Chatham House, https://www.chathamhouse.org/publication/woody-biomass-power-and-heat-impacts-global-climate
This is in no way a justification for continued fossil fuel energy usage, which needs to be rapidly phased out in a just and equitable manner.

18 Letter from Scientists to the EU Parliament Regarding Forest Biomass, updated January 2018, dropbox.com/s/l8sx5bl0h02x395/UPDATE%20800%20signatures_Scientist%20Letter%20on%20EU%20Forest%20Biomass.pdf?dl=0

19 John D Sterman et al. 2018: Does replacing coal with wood lower CO_2 emissions? Dynamic lifecycle analysis of wood bioenergy, Environ. Res. Lett. 13, http://iopscience.iop.org/article/10.1088/1748-9326/aaa512/meta

20 Brack, Duncan. The Impacts of the Demand for Woody Biomass for Power and Heat on Climate and Forests. Chatham House. February 2017. chathamhouse.org/publication/impacts-demand-woody-biomass-power-and-heat-climate-and-forests

Conclusion

We call this work a 'Threat Map' because we believe that the global expansion of forest based power generation is not a climate solution but represents a threat to climate, as well as a threat to the world's forests.

The last ten years have seen a doubling of biomass energy supply and a quadrupling of pellet production. Alarmingly, even more rapid growth is forecast for the coming decade – over 250 % increase in biomass demand.

The wood pellet trade is at the heart of the biomass industry and is central to the industry's global expansion plans, both in scale (extent of forests impacted) and in geographical focus (creation of long-distance supply chains and expanding new centers of consumption).

We hope this will be a wake-up call to those **governments** that are subsidising coal to biomass conversions; will persuade **investors** that financing biomass power is not sustainable; and will persuade **energy analysts, retailers and consumers** to distinguish forest biomass, as a high-carbon renewable energy technology, from lower-emitting technologies like wind and solar.