Biomass and Bioenergy

Biomass is the oldest energy source used by humans. It is found in abundance in almost every part of the planet and today, more than two billion people depend on it for cooking, heating and lighting, particularly in the countries of the global South. Energy produced from biomass is called bioenergy.

One of the traditional ways of generating bioenergy is from biomass in solid form, such as firewood. But technological development has also made it possible to obtain energy from wood chips and wood pellets. Biomass can also come in liquid form, such as ethanol (produced from crops like sugar cane, maize and wheat) and biodiesel (made from oilseed crops like oil palm, jatropha, sunflowers and soy beans), and in gas form, such as biogas.

Since the Industrial Revolution, fossil fuels – oil, natural gas and coal – have become the main source of energy in the global North and, later, in the globalized economy.

However, over recent years, concern has grown over the decline in easy access to petroleum. At the same time, the large-scale use of fossil fuels is also the primary cause of climate change, resulting from the global warming provoked by excessive emissions of carbon dioxide and other greenhouse gases released into the biosphere, as a consequence of current models of production and consumption.

Governments and corporations in the world's largest economies have supposedly joined forces to confront climate change, promoting alternative energy sources which, they claim, will reduce carbon dioxide emissions.

Renewable energy vs. fossil energy

What is renewable energy?

The World Energy Council defines renewable energy as "energy made available as [a result] of permanent and natural energy conversion processes, economically profitable in present conditions or in the near future." In accordance with this definition, renewable energy comes in various forms, including bioenergy, wind power, hydropower, geothermal energy and tidal power.

Investments in renewable energy have more than doubled in the last five years, reaching over 260 billion dollars worldwide in 2011, of which 187 billion dollars was invested in electricity generation. However, there are serious concerns about this broad definition of "renewable energy", which includes unsustainable and high-carbon types of energy such as large-scale hydro dams, agrofuels and industrial biomass. After all, the lands and ecosystems destroyed for these are not "renewable" within the near future.

What is fossil energy?

Fossil energy is produced from fossil fuels like crude oil, natural gas and coal. These three energy sources are actually biomass produced and accumulated through very slow processes over the course of millions of years. They are found beneath the earth's surface in highly concentrated form, and are the product of the remains of dead animal and plant organisms that settled to the bottom of the seas, lakes and swamps. Fossil fuels are not considered renewable sources of energy because they take millions of years to form, and reserves are being depleted far faster than they can be replaced. Every year we burn fossil fuels worth 400 years of plant and animal matter concentrated into fossil fuels over millions of years.

Up until now, support for so-called renewable energy sources, such as bioenergy (from biomass), wind power and solar power, has largely resulted from the funding and policies of the countries of the North, particularly the European Union and the United States.

In the 1970s, Brazil and later the United States became the world's first countries to promote the large-scale use of so-called "biofuels", through ethanol production programmes. Over the last decade, they have been followed by a number of other countries, leading to a "boom" in the use of this type of fuel.

Worldwide production of "biofuels" in the year 2000 was 16 billion litres, and had shot up to 100 billion litres by 2010.

Peasant farmer movements like La Via Campesina consider so-called biofuels produced from industrial monocultures to pose a threat to peasant communities and food sovereignty. This is why they determined that it would be more apt to eliminate the prefix "bio", which means life, and refer to them as agrofuels, as a means of stressing that this is above all a big business dominated by big corporations, leading to ever increasing concentration of land ownership, in addition to other serious social and environmental impacts.

First and second generation agrofuels

First generation:
*Ethanol (conventional), produced from crops such as sugar cane, maize, wheat, etc., through the fermentation of hydrolyzed biomass
*Biodiesel, produced from vegetable oil (from oil palm, jatropha, sunflowers, soybeans), through cold pressing/extraction and transesterification

Second generation:
* Cellulosic ethanol, produced from the cellulose extracted from cellulose-rich biomass (trees, straw, grasses), through enzymatic hydrolysis (e.g., by way of genetic engineering)
* Synthetic biofuels, produced from the cellulose extracted from cellulose-rich biomass (trees, straw, grasses), through thermochemical conversion processes (pyrolysis or gasification and synthesis)

As of now, second generation agrofuels remain in the research and development stages and are not yet commercially available, due to the fact that producing them consumes more energy than is released by burning them.

The big business of bioenergy

It is important to note that energy consumption around the world is very unequal and very poorly distributed. The energy consumption per person in the United States is more than 11 times bigger than in Africa, and in the EU, it is about five times bigger. While the countries in the North consume excessive amounts of energy, particularly from fossil fuels, the majority of people in the countries of the South cannot even cover their basic energy needs. There are approximately 1.3 billion people in the world, the vast majority of them in the global South, who have no access to electricity.

Nevertheless, governments and large private corporations in the North have no plans to reduce their levels of consumption. Instead, their intention is to complement fossil fuel consumption with other energy sources, which is why they are investing in so-called renewable energies, and especially bioenergy.

The promotion of bioenergy, as a way to continue supplying the high levels of consumption in the North and among the elites in the South, benefits a number of powerful economic sectors, like the forestry, agriculture and energy sectors – for example, through the expansion of large-scale monoculture plantations to produce raw materials, or the development of all of the infrastructure and technology needed to harvest, transport and store biomass and to convert it into bioenergy.

It is leading to new and powerful alliances, for example between agribusiness, biotech and oil companies (for agrofuels) and energy and timber companies (for wood-based biomass).

Above all, it incentivizes a vast new corporate land and resources grab in pursuit of new commodities, such as sugar cane ethanol or wood pellets.

In the meantime, bioenergy is one of the pillars of the so-called “green economy” or “bioeconomy”, pushed forward by big capital as the ideal solution to continue with business as usual, reaping profits through the promise of a sustainable future, at the expense of the destruction of nature.

The creation of a global bioenergy market is certainly highly promising for investors and transnational corporations, providing them with major business opportunities which are especially welcome during the current worldwide financial-economic crisis, especially in the global North. However, as will be demonstrated further on, it does not represent a genuine solution to either the energy crisis or the climate crisis.

Energy generation from wood biomass

Most of the biomass used for heat and electricity is wood, with smaller contributions coming from agricultural residues (such as palm oil and sugar cane residues or straw) and (to a far smaller extent) from “short rotation coppicing”, i.e. fast growing plantations for example of willow or miscanthus. Some countries also classify various types of waste incineration as “biomass”.

Among renewable energy sources, bioenergy from wood biomass was initially presented as a type of recycling that takes advantage of wood waste, such as sawdust. Some of the wood comes from forests, largely from so-called “secondary forests” (which have suffered major alterations), as in Europe, for example. However, an ever growing number of whole trees are being used, and monoculture tree plantations are being established specifically for this purpose.

Wood biomass has been transformed into a new market for which big industry is promoting new types of commodities, such as wood chips and wood pellets, used for both industrial and household electricity generation and heating.

The current growth in the use of wood for bioenergy is reflected in part by the production of wood pellets. Between 2006 and 2011, worldwide wood pellet production grew from around six to seven tonnes to 14.3 million tonnes. Installed production capacity is greatest in North America (the United States and Canada), followed by Germany, Russia and Sweden. The southern United States is currently the world's biggest wood pellet producer, while the biggest consumers are Belgium, the Netherlands, the United Kingdom, Sweden and Denmark.

How it is promoted: subsidies, deceptive arguments and created demand

As mentioned earlier, wood-based bioenergy is being promoted through a range of subsidies and in some cases mandatory targets in Europe and North America. Those include renewable energy subsidies set up by EU member states to meet the overall 20% renewable energy target by 2020, co-firing mandates such as those announced in the Netherlands, biomass inclusion into Renewable Portfolio Standards in 30 US states, and tax incentives in the US.

The EU's "green" energy targets and subsidies offer definitive support for big agroindustry, the forestry industry and bioenergy production, because they contribute to market trust and stability. And support is not lacking. Biomass and biofuel production receive an average of 75% of subsidies for renewable energy sources in the EU, while the remaining 25% are divided among the other sources. This results in a major imbalance, with two thirds of "renewable" energy in the EU sourced from biomass, while only a third is generated from all other renewable sources combined: solar energy, wind power, hydropower, etc.

For its part, the UK government has provided for generous subsidies for the production of electricity from solid biomass, which are the main driver for industry investments. If the ambitious plans announced by industry so far are realized, they will attract around three billion pounds sterling in subsidies every year

Bioenergy produced from wood biomass has been publicized by companies and governments who promote its use as a way of taking advantage of waste wood and forestry residues, and claim that residue removals from logged forests and plantations will provide "benefits" such as avoiding CO2 and methane emissions from decomposing biomass, as well as preventing forest fires. However, this argument is faulty: removing forest residues for bioenergy use negatively affects the nutrient cycling of the forest's soil, depletes soil carbon, erodes and compacts soils and thus affects their ability to hold water, reduces future tree growth and decimates biodiversity. Increasingly, aggressive logging methods such as whole tree harvesting (involving the removal of all parts of the tree from forests) and stump harvesting are used, both in existing tree plantations and in biodiverse forests.

Moreover, the available supply of wood waste today is already insufficient to meet bioenergy production needs, leading to an ever greater demand for whole trees and quality wood for this purpose, increasing pressure on forests and promoting the expansion of monoculture tree plantations for energy production. This debunks the argument that wood biomass energy is merely a way of making use of waste materials.

Another argument frequently used to promote the use of wood biomass is the fact that trees are not food crops, so it is a way to avoid the ethical dilemma of "food for the dinner plate versus food for the fuel tank." In reality, however, eucalyptus and jatropha plantations displace food crop production in exactly the same way as wheat or maize crops for ethanol production.

The way that the United Nations Food and Agriculture Organization (FAO) defines industrial tree

plantations is another factor that contributes to the expansion of tree plantations in general. The fact that FAO defines them as “forests” serves to legitimize them as something “good”.

> *Monoculture tree plantations are not forests*
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> FAO’s definition of “forest” basically classifies any area of land with a certain number of trees as a forest. This is largely influenced by the close links between FAO and the forestry industry, and particularly the pulp and paper industry. By legitimizing these plantations as “forests”, FAO helps plantation companies to convince the authorities and the public that they do not harm the environment, since they supposedly provide the same benefits as forests.

Studies by consultants and specialist institutions that present future scenarios in which there is a certain “need” or “demand” for wood biomass also serve to promote the sector. For example, the International Energy Agency (IEA), which is financed by the governments of the economies that consume the most energy and is heavily influenced by energy companies, envisages in its “roadmap” for the future that by 2050, bioenergy will meet 7.5% of the world electricity demand. As such, between five and seven billion tonnes of dry biomass (wood) will be needed for heat and power generation in 2050, along with another three to four billion tonnes for biofuel production. According to the IEA, studies indicate that in order to meet this demand, wood residues and forest waste will need to be supplemented by “purpose grown energy crops” – in other words, tree plantations primarily, although plantations of usually invasive grass species like switch grass (Panicum virgatum) and miscanthus are also being promoted.

Studies like these, in turn, can be used by industry to lobby governments for incentives and subsidies, which the industry claims to be necessary for biomass targets to be met. Obviously, the potential for receiving subsidies is yet another factor that motivates companies to get involved in the bioenergy business.

The Common Agricultural Policy and incentives for “energy crops”

One common element among the EU countries is the Common Agricultural Policy (CAP), which signified the end of traditional agriculture in Europe. The expansion of “energy crops” as a productive alternative to the abandonment of agriculture is currently one of the most ambitious objectives within EU policies on renewable energy. CAP promotes forestation, including the conversion of farmland into tree plantations, and the processing and marketing of forest products. It also foresees possible subsidies for the forestation of farmland.

In 2005, an estimated 3.6 million hectares of agricultural land in the EU was devoted to biomass production for energy use. According to projections, 19 million hectares of agricultural land in Europe will be exclusively devoted to bioenergy production in 2030, which will have repercussions for biodiversity as well as food production and food sovereignty in general, increasing the need for imports of food and raw materials.

The snake in the woodpile: monoculture tree plantations

It is noteworthy that the expansion of monoculture plantations of agricultural crops for agrofuel production has been widely criticized, not only by social movements and environmental organizations, due to the negative impacts on the food sovereignty of countries and continents, but

also by authorities like the former UN special rapporteur on the right to food, Jean Ziegler, who declared in 2007 that the conversion of food crops into biofuel is a “crime against humanity”.

Monoculture plantations of oil palm for the production of biodiesel have been harshly condemned as a direct cause of deforestation, especially in Indonesia and Malaysia, the two main producer countries. These criticisms led the European Commission to publish, in October 2012, a proposal to limit land conversion for agrofuel production. Commissioner for Climate Action Connie Hedegaard stated: “For biofuels to help us combat climate change, we must use truly sustainable biofuels. We must invest in biofuels that achieve real emission cuts and do not compete with food.”

However, this proposal would not signify a real limit on the expansion of “biofuel” crops. Even if it were possible to produce “sustainable biofuels” (which would not contribute to carbon emissions), they would still require fertile land and water. It is the scale of plantations of these crops that determines their impact on food sovereignty.

Over the last 30 to 40 years, monoculture tree plantations have expanded to an ever greater extent in the countries of the South, simply because of what they offer to companies, especially pulp and paper producers: cheap labour, cheap land, less stringent environmental standards, and generally high per-hectare productivity. Southern countries like Brazil, Chile, Uruguay and Indonesia can produce eucalyptus hardwood at rates of 20-44 m3/ha/year, as compared to rates of 4-6 m3/ha/year on plantations in Northern countries with wood-based industries, like Sweden and Finland. However, for local communities, industrial tree plantations of any kind, as is the case with other large-scale monoculture plantations, usually mean incalculable losses and violent conflicts.

Tree plantations lead to the displacement of local communities from their territories, often through violent methods, and/or the partial or total occupation of lands that local communities have traditionally used for their survival.

The loss of land and subsequent establishment of large-scale tree plantations brings about countless impacts that negatively affect the lives and livelihoods of local communities. The replacement of local ecosystems with industrial monoculture plantations results in the loss of biodiversity, a shortage of land for agriculture, problems with the supply of water, the contamination of water resources, the destruction of sacred areas, the loss of traditional knowledge. Even when the promoters of tree plantations argue that the plantations are established on “degraded lands”, these are often precisely the lands used by local communities to grow crops, or lands that have been left fallow after being farmed for a certain period of time. Even forest areas that have been degraded by logging activity are often recovered by local communities, and the secondary forest growth provides them with numerous benefits, such as medicinal plants, protein from hunting, fruit and other foods, areas for spiritual retreat, etc. At the same time, the promises of job creation and improved living conditions for local communities do not materialize; the reality turns out to be quite the opposite.

In addition to these impacts, biomass energy plantations have become another driver of the growing problem of “land grabbing”, which is generating conflicts and further negative impacts by threatening local communities’ use and control of their lands in Latin America, Africa and Asia. According to a 2012 European Union Parliament report, “The rising demand for woody biomass energy is likely to raise the global price for wood, thus adding pressure on forests and other ecosystems and driving land use conflicts. More specific risks include deforestation when natural forests are replaced by monoculture plantations and long term impacts on local food and energy security.”

In Brazil, the creation of plantations specifically geared to the production of wood pellets and chips,

using densely planted eucalyptus trees with a rotation cycle of two to three years, is still in its initial stages. It is therefore difficult to assess the differentiated impacts of this type of plantation, compared to “conventional” eucalyptus plantations with cycles of six to seven years. Nevertheless, one can assume that the shorter cycles will increase the pressure on available soil nutrients and water resources. One can also assume that shorter rotations of two to three years will lead to increased use of toxic chemical herbicides to prevent competition from other plants and thus foster the growth of the trees. This in turn will exacerbate the problems caused by the use of these products.

The use of genetically modified trees

Another troubling aspect of this new type of plantation is the use of genetically modified trees. The biotech company FuturaGene recently announced that its genetically modified eucalyptus trees can grow five metres a year – 40% faster than normal – with 20% to 30% more mass than a normal eucalyptus. The company has tested the trees on trial plantations in Brazil, China and Israel, and is currently in the final stages of obtaining authorization for commercial planting in Brazil

Genetic modification is also being used to develop resistance to the toxic agrochemical most frequently used on monoculture eucalyptus plantations: glyphosate.

Tree plantations in the south for bioenergy production

In the global South, where there are already approximately 60 million hectares of land occupied by industrial tree plantations, plans and projects are being developed in Asia, Africa and Latin America for the establishment of tree plantations geared to bioenergy production for export, in response to the growing demand in the North.

Projections of the demand for biomass for bioenergy production in the EU, driven up by EU targets and incentives, indicate that growing amounts of raw material will need to be imported to meet this demand. The National Association of Wood Panel Manufacturers (ANFTA) of Spain estimated in 2010 that in order to achieve the biomass targets in different EU member states for 2020, 700 million cubic metres of wood would need to be imported for burning annually. According to projections, there are only 800 million cubic metres of wood (from harvesting and recycling) available annually in Europe, and the bulk of this is devoted to other uses such as construction, furniture manufacturing and pulp and paper production. These uses require up to 500 million cubic metres of wood annually. When this is added to the demand for wood as biomass, the resulting total demand is 1.2 billion cubic metres. In accordance with these estimates, which coincide with those of FAO, there will be a shortfall of 400 million cubic metres in the EU by 2020.

An analysis of data and trends conducted by James Hewitt for FERN in 2011 estimated that the use of wood for fuel in the EU will increase by between 100 and 200 million cubic metres, and that in most EU member states, the currently existing area of productive woodland and forest is unlikely to be large enough to meet the substantial increases in the volume of woody biomass required. However, those figures could prove to be serious underestimates given the more recent trend towards coal-to-biomass power station conversions and massively increased co-firing by several European energy companies.

The demand for wood pellets in the EU has significantly outstripped the domestic supply since 2008, with more than three million metric tonnes imported in 2011. Studies foresee the use of wood pellets primarily for the co-generation of electricity in large-scale plants, in addition to household use.

The same studies predict major expansion of monoculture plantations of fast-growing trees in the South for export to the EU by 2020. One potential scenario foresees a total of close to 15 million tonnes of wood pellets produced, much of it in the South, such as in Brazil, Uruguay, Mozambique and western Africa. Given recent announcements by European energy companies about their biomass plans, the real figure could be much higher. Fifteen million tonnes of wood pellets would require at least 450,000 hectares of plantations, in the case of eucalyptus for biomass in Brazil, which has a short rotation cycle of two to three years and a much higher per hectare yield than other sources.

Asia

In **Cambodia**, in 2008, South Korean electricity giant Kenertec was granted a concession for a total of 60,000 hectares of land by the Council for the Development of Cambodia, an area which is six times the area allowed under Cambodia's land law. Besides mining activities, the company plans to plant rubber trees, cassava and jatropha and develop a complex to process the wood. Local contacts from Cambodia told WRM that the concession area granted to Kenertec for the biomass project is in the Prey Long forest area. The Prey Lang Forest, spanning Preah Vihear, Kompong Thom, Kratie and Stung Treng provinces in northern Cambodia, are inhabited by nearly 350,000 indigenous people, primarily of Kuy descent. As such, the Prey Lang forest area is the last large contiguous area of indigenous peoples' land remaining in Cambodia.

In the **Philippines**, on the outskirts of the city of Butuan, the Japanese company EJ Business Partners Co., Ltd. is developing a project involving both tree plantations and a biomass power plant with a capacity of 10 MW. It is aiming to begin operations in 2017.

In **Indonesia** there are a number of woody biomass plantation projects. In 2009, through a memorandum of understanding between the Korea Forest Service and the Forest Ministry of Indonesia, South Korea was granted a 99-year lease on 200,000 hectares of land in the Central Kalimantan region to establish plantations for the production of wood pellets. Of the total area, 180,000 were to be developed by the private sector. Based on information from WRM's local partners, the land was allocated to Korindo and it established monoculture tree plantations in Kotawaringin Barat and Lamandau, Central Kalimantan to feed the Korindo Pulp Mill in Kerawang (West Java).

In 2011 it was announced that two South Korean companies were planning "to develop wood pellet industries in West Sulawesi in a bid to produce biomass energy as the country starts to gradually shift from coal-based energy." The Ministry of Forestry gave permits to two South Korean firms – PT Bara Indoco and PT Bio Energy Indoco – to open up a 200,000 hectares of industrial forest estate in West Sulawesi to support the planned wood pellet industries.

Another South Korean firm, PT Solar Park Energy has also made similar investments in Wonosobo, Central Java, partnering with the state-owned company Perhutani, developing a 200,000 ton per year wood pellet industry.

Finally, in the region of **West Papua**, there are two major projects involving tree plantations for bioenergy. One is being undertaken by the UK company Carbon Positive, which is establishing 160,000 hectares of tree plantations. The second is being undertaken by the Indonesian company Medco with investment from the Korean company LG International, and involves the development of a million hectares of tree plantations for wood pellet and woodchip production

South America

In South America, **Brazil** stands out as one of the main potential suppliers of wood for energy production in the North. Since the 1970s, Brazil has had over a million hectares of eucalyptus plantations, concentrated in the state of Minas Gerais, which are specifically geared to energy generation. The eucalyptus trees are harvested and used to produce charcoal, for use in some 200 iron and steel mills that primarily produce pig iron.

Tree plantations are now being established in Brazil for the specific purpose of producing wood for power generation, including to meet the growing demand in Europe. Since 2005, experiments have been carried out with eucalyptus trees planted more densely to determine potential yield in terms of biomass per hectare. In 2007, a pilot project was initiated in the state of São Paulo involving a plantation of densely planted trees to supply energy for an ethanol refinery. In 2009, in the state of Tocantins, GMR Florestal established its first pilot plantation with eucalyptus clones to produce 33 MW of electricity. Today the same company plans to expand its plantations in the region to a total of 350,000 hectares. Also in 2009, in the state of São Paulo, Grupo Bertim began pilot tests with eucalyptus clones for biomass production.

Technicians from Uruguay, Chile, Mexico, Nicaragua and Guatemala have already visited the region, which clearly demonstrates the interest of the forest industries in those countries in developing these types of plantations.

Among recent developments are the plans announced by Suzano Papel e Celulose to establish large-scale eucalyptus plantations for wood biomass production in northeastern Brazil. Suzano is the world’s second largest producer of eucalyptus wood pulp, with five pulp mills in Brazil. It currently controls 722,000 hectares of land including 324,000 hectares of eucalyptus plantations in the states of Bahia, São Paulo, Espirito Santo, Minas Gerais, Tocantins and Maranhão.

In mid-2010 the Suzano Group created a new company called Suzano Energia Renovável (Suzano Renewable Energy). The proposed investment amounts to 1.3 billion US dollars, and includes five wood pellet plants, with a total production capacity of five million tonnes per year. The first phase involves land acquisitions and the construction of three wood pellet plants, producing one million tons each, which would start operating in 2013. Suzano expects a liquid income of 500 million dollars in 2014, and already has guaranteed sales contracts for 2.7 million tons. A memorandum of understanding was signed between Suzano and the UK company MGT Power Ltd. in August 2010.

Field trials with eucalyptus and acacia were carried out in the northeastern Brazilian states of Piauí and Maranhão in 2009. The company's director, André Dorf, declared in 2010, “The lands have already been prospected and the acquisition process will continue this year.” He also stressed that the company preferred the northeast “because of the proximity of major ports which facilitate the flow of production, since our aim is to supply the European continent.” According to Dorf, around 30,000 hectares of land are needed to produce one million tons of wood pellets. Considering Suzano’s goal of producing five million tons of wood pellets, the company will require a total of 150,000 hectares.

Land acquisitions for the establishment of eucalyptus plantations for pulp production are already causing serious problems in northeastern Brazil. In this region, for example, quilombola communities – established by descendants of escaped African slaves – are still fighting for official recognition of their rights over their traditional lands. Inaldo Serejo, a coordinator with the Pastoral Land Commission in Maranhão, warned in an interview that “companies like Suzano Papel e Celulose have been buying up vast tracts of land, currently occupied by traditional communities, to plant

eucalyptus trees." It can only be expected that these problems will increase with the expansion of the new biomass plantations.

Uruguay and **Argentina**, another two countries where the impacts of industrial tree plantations have already been problematic, are also emerging as potential suppliers of wood for energy production, which would entail the further expansion of tree plantations in both countries

In **Guyana**, the U.S. company Clenergen has reportedly leased 2,000 hectares of land (with the option to lease an additional 58,000 hectares), hoping to export wood chips to the United States and the United Kingdom. The company also intends to establish plantations in Madagascar, Mozambique and Tanzania to export wood chips for biomass power to southern Africa and India. It also has projects underway in the Philippines and Ghana.

Africa

In Africa, numerous companies have been investing in tree plantations for energy production for a number of years. Green Resources, a private company based in Norway, has been operating in Mozambique, Tanzania, Uganda and South Sudan since 1995. The company currently holds more than 300,000 hectares of land in the countries where it operates, including 22,000 hectares of forest, and it aims to establish over 100,000 hectares of plantations to serve the rising regional and global demand for wood products. Its business strategy is based on growing wood for both traditional uses and for a burgeoning new sector: bioenergy. It is currently establishing two large-scale plantations in Mozambique and Tanzania.

In **Mozambique**, tree plantations have already sparked numerous conflicts in the areas where they are expanding. One of the areas that have seen the greatest expansion, as well as the worst conflicts, is the province of Niassa, the largest province in the country, which offers large stretches of level, fertile land. Companies promoting large-scale pine and eucalyptus monoculture plantations began moving into Niassa in 2005. Niassa has a relatively small population of one million people, but 70% to 80% of them live in rural areas. Since 2007, when these companies began planting trees, Mozambique's largest peasant organization, the National Union of Peasant Farmers (UNAC), has repeatedly denounced and opposed the planting of eucalyptus trees on lands that belong to peasant communities. This reduces their access to land for planting crops and poses a serious threat to the food security and sovereignty of both the local communities and the region as a whole

In **Tanzania**, Green Resources has three main tree plantations in the southern highlands. In total, the company has been allocated more than 100,000 hectares of land in the region in various stages of the land acquisition process. The company's activities here have already caused serious conflicts with local communities, as documented in a 2011 report from Timberwatch.

In the **Republic of Congo**, between 1991 and 2001, Shell Renewables, a division of Shell Oil International, established plantations of fast-growing cloned eucalyptus trees on 68,000 hectares of land, with the aim of establishing a high-yield source of biomass for future energy generation. Shell later sold its plantations. MagForestry – the forestry division of MagIndustries, a Canadian company involved in industrial and energy projects in Central Africa (particularly in the Republic of Congo and the Democratic Republic of Congo) – took over control of Shell's eucalyptus plantation through the acquisition of all the shares of Eucalyptus Fibre Congo S.A. (EFC), the lease holder of the industrial plantation.

MagForestry has been allocated the forest concession by the Congolese government until 2075.

Currently, 70% of the land is being used to grow fast-growing eucalyptus clones. The company has also begun planting on another 20,000 hectares.

In 2006, the company began construction of a wood-chipping plant in the Atlantic port city of Pointe-Noire, with the aim of supplying the growing market for wood biomass in Europe and North Africa. Built with an investment of 36.7 million dollars, the plant went into operation in 2008, and has a production capacity of 500,000 tons of wood chips a year, which the company plans to increase to 1.5 million tons by 2018.

For the moment, however, those plans have been frustrated by illegal logging on the eucalyptus plantations, beginning in 2011. There are different versions regarding those responsible for the logging and their motives. A newspaper article on a visit by government authorities to the area in August 2011 lays the blame on local communities. At that point, 7,750 hectares had been cleared, resulting in economic losses estimated at 22 billion CFA francs (around 42 million US dollars). The illegal logging continued in 2012, when another newspaper article reported that “the bulk of this business is being shared among a large number of big landowners with the support of networks that involve the military, police, judges and high-ranking officials.”

In **Liberia**, one of the poorest countries in the world, there are approximately 260,000 hectares of industrial rubber tree (Hevea brasiliensis) plantations in the country, including the world’s largest rubber tree plantation, run by the Japanese-U.S. multinational Bridgestone-Firestone. Reports by local NGOs like SAMFU and the United Nations describe disastrous working and social conditions on the plantations, especially those run by Bridgestone-Firestone. There are charges of, among other abuses, child labour, violence and a general absence of legality.

Buchanan Renewables Fuel (BR Fuel), owned by Pamoja Capital, a Swiss-based private investment firm, produces wood chips from rubber trees in Liberia and exports them to Europe. Initially, BR Fuel produced these chips with trees harvested from the smallholdings of peasant farmers, many of whom had planted rubber trees along the borders of their farms to demarcate their landholdings – a common practice in a country where the land rights of rural communities are still not fully recognized.

The company's harvesting of trees gave rise to numerous problems and discontent among the local population. The business was conducted primarily on the basis of rather unclear verbal agreements, and conflicts arose over arbitrariness in terms of the species and volume of trees harvested, destruction of neighbouring fields of crops, and lack of payment. This led BR Fuel to begin mechanized harvesting on the Bridgestone-Firestone industrial rubber tree plantations near Kakata.

Buchanan Renewables had committed to building a biomass-powered plant to supply electricity in Liberia before exporting wood chips, but these promises have yet to be fulfilled.

In Liberia, the population’s primary energy sources are firewood and charcoal. According to the United Nations Development Programme (UNDP), 99.5% of households cook with firewood. The rainforests, mangroves and old rubber trees are the main sources of this wood. The supply is primarily met by thousands of informal firewood collectors and small-scale sellers.

The Ministry of Energy of Liberia stated in its 2007 Renewable Energy Action Plan that “scarcity of firewood is becoming a serious problem in most parts of Liberia, especially in Montserrado County [around the capital, Monrovia].” Nevertheless, BR Fuel has been exporting rubber tree wood chips to Europe for electricity production there since 2009, while the Liberian people remain without electricity and with serious difficulties in meeting their energy needs.

In **Ghana**, the U.S. company Clenergen – which is also operating in Guyana – has reportedly acquired a 49-year lease on 5,000 hectares of land to establish bamboo plantations for the production of wood chips for biomass power plants.

Also in Ghana, a deal has been reported between the Danish utility Verdo Group that has contracted with UK-based Africa Renewables Ltd. (AfriRen) for 826,700 tons of wood chips over five years, produced from rubber trees.

A false solution for the energy crisis and climate change

Bioenergy, with its new industrial-scale demands for wood, agricultural products and other types of plant biomass, is provoking serious and irreversible impacts on biodiversity, especially in forests. Driven by foreign investment, vast tracts of land in the global South are being converted to the production of raw materials for bioenergy production.

It is unlikely that bioenergy will come to replace a significant share of the excessive and large-scale consumption of fossil fuels in the countries of the global North, or supply the big globalized markets. The first problem is the enormous amount of land that would be required if plant biomass would be used to substitute fossil fuels. Today, coal, oil and gas supply the equivalent of phytomass from well over 1.25 billion hectares, while using a land area of only three million hectares (the area taken up by the global extraction, processing and transportation of fossil fuels, together with the generation and transmission of thermal electricity).

Hartmut Michel, director of the Max Planck Institute in Germany and a Nobel laureate for his research on plant photosynthesis, explains the main reason for this: plants are very inefficient in converting the energy from solar radiation into biomass compared with the energy efficiency of fossil fuels, especially petroleum. Only around 0.5% of solar energy is captured by plants in the form of biomass. And the cultivation, harvesting and processing of biomass require a large amount of fossil fuel energy, which would need to be subtracted from this percentage.

The generation of one MW of electricity a year requires roughly 13,000 green tons of wood. Based on this estimate, a 50 MW power plant would burn around 650,000 tons of wood annually. In Brazil, whose eucalyptus plantations have the world’s highest wood productivity rates (44 m3/ha/year), 14,700 hectares of land would be needed to produce this amount of wood. In Sweden, with a wood productivity rate of 6 m3/ha/year, it would take around 108,300 hectares. Considering that electricity consumption in the United Kingdom totalled 1,636 TWh in 2010, if this demand were to be met with wood pellets from tree plantations, even in the case of the highly productive eucalyptus plantations of Brazil a whopping 55 million hectares would be needed.

A recent report, “Bioenergy: Chances and Limits”, presents the findings of more than 20 expert scientists who researched the potential of bioenergy in Germany for close to two years. They reached the conclusion that “in quantitative terms, bioenergy plays a minor role in the transition to renewable, sustainable energy sources in Germany at the present time and probably in the future,” and consequently issued a call in July 2012 to the German government and the EU to correct their policies.

To back up their conclusion, they argue that bioenergy requires more surface area, is associated with higher greenhouse gas emissions and is more harmful to the environment than other renewable energy sources, in addition to potentially competing with food crops. They also expose how Germany – a pioneer in environmental initiatives – is greenwashing its image at the expense of others, given

the ever growing amounts of raw materials that need to be imported from abroad, such as soy biodiesel from Argentina, sugar cane ethanol from Brazil, and more and more wood pellets from North America.

Meanwhile, to promote bioenergy, the argument is used that burning biomass releases the same amount of carbon dioxide that trees fix from the atmosphere and convert into biomass as they grow. This supposedly means that bioenergy is “carbon neutral”, or that at least fewer carbon emissions are released. This premise is erroneous and is based on partial or incomplete calculations.

Throughout the bioenergy production cycle, enormous amounts of resources are required, such as water, fertilizers and pesticides, which are heavily used on monoculture plantations. Bioenergy production also involves intensive use of fossil fuels for harvesting, transportation, storage and industrial processing to convert biomass into wood chips, wood pellets, biofuel or biogas.

To determine the real impact of agrofuels on the climate, the calculations would have to account for the use of all of these resources and the emissions produced through all of these processes, along with their direct and especially indirect impacts, particularly on land use change. Once all of these factors are added up, the supposed benefits for the climate disappear. Plantations for agrofuel production are taking over forested areas and other ecosystems like grasslands that have stored carbon for thousands of years. When these ecosystems are destroyed, enormous amounts of carbon dioxide are released into the atmosphere.

As a result, actual CO2 savings are minimal and often negative. EurActive gained access to a leaked report on studies commissioned by the EU, which conclude that agrofuels are far from being carbon neutral, and their use can even result in higher CO2 emissions than those released by burning fossil fuels. For example, using palm oil as agrofuel leads to 25% more CO2 emissions than fossil fuel diesel. And producing 1 MWh from burning wood-based biomass releases around 50% more CO2 than generating the same from coal.

No to this kind of bioenergy! Yes to urgently needed change!

The increase in industrial monoculture tree plantations in the South for bioenergy production is leading to an increase in social, environmental and climate injustice. The promotion of bioenergy based on large-scale monocultures even further delays the adoption of the structural measures needed to truly confront the social, energy and climate crises.

Both agrofuel production and tree plantations for biomass production lead to the expansion of a model of export-geared industrial monoculture plantations on lands that could be used to ensure the livelihoods of local communities.

There is another possible course of action that could be pursued instead of using unsustainable industrial bioenergy as a substitute for fossil fuels. This report aims to serve as a further incentive for the urgently needed change in the patterns of excessive energy consumption and production that is overly dependent on imported energy sources – formerly fossil fuels, and now increasingly also biomass.

Until governments adopt the measures needed to curb the expansion of so-called energy plantations in the South, and also in the North, it is up to civil society and social movements in the South and North to work together to confront this dangerous new trend, and to continue the struggle to ensure that land use is geared to meeting the needs of local populations, to contributing to food sovereignty,

and above all, to building a more just world.