

What can we expect from wood pellets? ¹

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Wood pellets are booming. They have the potential (allegedly):

- to provide low-cost energy
- to save exhaustible resources
- to reduce our dependence from politically instable countries

and above all, they can

- deliver a significant contribution to the reduction of CO₂ emissions.

And because of this last benefit, they become

- an important tool to comply with our commitments to mitigate climate change based on the Kyoto Protocol.

Since wood pellets represent another use of solar energy, we should welcome and value their contribution to society.

A reader requested Energie-Fakten for an assessment of the above statements.

We've already taken a position on this subject in a previous answer 'Can biomass power stations mitigate climate change?' Hereby a few additional remarks.

Preliminary note

First of all, we must alert readers to a major distinction: wood pellets can be produced from waste resulting from other wood processing activities - e.g. the furniture industry - or they can be harvested from natural or planted and cultivated trees and bushes (so-called energy plantations). The use of wood residues is basically beneficial, since the raw material for the pellets can be obtained for free (except for the cost of transport, to the extent that the material is not processed on-site) and without a need for further processing. But the volume is relatively small and this type of wood pellets will not make

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a big difference. In principle, we could produce larger volumes in energy plantations. In this case, we must take into account all expenditures of these plantations (planting, where applicable irrigation, manuring, maintenance, as well as wood chopping and transport) including the machinery, installations and operating supply items required, and also all effects of these energy plantations and their cultivation allocated to the final product - wood pellets. In the latter case, a much more detailed assessment is required.

Technically, equipment for the production and combustion of wood pellets is mature. They operate reliably, without major impact on environment and the equipment for private users (stoves) are sufficiently user-friendly and adequately failure prone. And social acceptance will not be a market barrier.

Low-cost energy

Wood pellets from waste wood are cheap. From energy plantations, despite rising energy prices, wood pellets can still not compete with natural gas, heating oil or coal. When energy prices further increase, economic efficiency will be within reach eventually. We should observe that part of the cost of wood pellets depends on energy costs. With rising energy prices, the cost of wood pellets will increase. Wood pellets will close the cost gap slower than is generally expected. Note as well that transport costs are relatively important, because of the low energy density of wood pellets. Transport from low density areas over long distance to large cities should only be considered on a limited scale.

Clean energy

Waste wood contributes to cleaning energy supply, but its volume does not suffice to make a difference. Energy plantations can make a substantial contribution, but a number of constraints needs to be observed:

First of all, land use for energy competes with land use for food. As long as many hundreds of millions on earth suffer from food shortages, this ethical question cannot be factored out. But even considering sufficient land available for energy use, it still remains to be seen whether wood is the most appropriate application. There are faster growing plants, and a conclusive decision is only possible under consideration of all aspects, for example need for manuring (including environmental impact and impact on total energy demand) and impact on biodiversity. In these areas, we have substantial knowledge gaps.

Land competition is also a factor with technical systems using solar energy: with plants (and trees), the bottleneck is the efficiency of photosynthesis. This is typically 1% (maximum around 5%) and hence substantially lower than the efficiency of technical systems (at

present around 10% for solar photovoltaics and around 30% for solar thermal electricity generation, in the latter case only referring to direct solar radiation, since scattered radiation is not usable for these systems; for Germany, scattered radiation represents about 50% of solar radiation, while in tropical areas, its share is substantially lower). Plants grow however by themselves (leaving out manuring and irrigation for a moment), while the technical exploitation of solar energy requires technical facilities (power plants). In the long run, we will see probably a parallel use of plants and technical systems, with technical systems probably taking the larger share.

Finally, we need to point to the need that in the long run, the share of solar energy (in whatever form) and nuclear energy to cover our energy supply needs to be decided on economic grounds, taking into account related requirements, such as security of supply ... But here as well, the choice is probably and/or rather than either/or.

Fuel dependency from politically instable countries

Since wood pellets inherently represent a domestic energy source, they could very well contribute to the increasing our energy independency. A sizeable contribution however depends on the use of energy plantations, whose large-scale application depends on the answer of other questions.

Reduction of CO₂ emissions

Combustion of wood pellets releases CO₂, exactly in the same amount previously captured. But this does not allow us to conclude that wood pellets are a CO₂ neutral energy source. All energy use for the setup and exploitation of energy plantations, the chopping of trees, transport and processing into pellets, as well as all energy consumption for the production and operation of these equipment and installations, produces CO₂ emissions. For pellets from waste wood, to the extent facilities are allocated to the main application, these are limited to the pellet production, and transport to the end user. Certified figures are not available, but I estimate that the corresponding CO₂ emissions are less than a tenth of what they would be when using fossil energy carriers rather than wood pellets. Wood pellets from waste wood are therefore an appropriate measure for CO₂ reduction, to the extent waste wood is available.

For energy plantations, this ratio is clearly less favourable. Also in this case, I do not know of any reliable figures, but when long-distance transports are to be taken into account, the benefit compared to using fossil energy carriers will shrink really fast, and in certain

cases can be completely consumed. Wood pellets from energy plantations are probably only practical on a limited scale to adequately reduce CO₂ emissions.

Considering CO₂ emissions, one should consider whether it wouldn't be better to directly burn wood, rather than converting it into pellets first. This conversion uses energy and releases CO₂. In any case, a significant part of the comfort offered by wood pellets would disappear. To a certain extent, we must value CO₂ emission reduction against comfort.

Another remark concerning CO₂: when considering climate change, the first priority should be to keep CO₂ from entering the atmosphere. Wood bonds carbon, and as long as it remains there, it does not enter the atmosphere. We must consider using wood for carbon storage, and cover our energy needs through other (CO₂-free) means. This means in principle other forms of solar and nuclear energy. With proper storage, wood can store carbon for a few centuries. By then, we will certainly have much better possibilities than today to protect us against climate change. Wood as medium for carbon storage is likely to be the better strategy compared to wood as fuel, whether we use the intermediate step of wood pellets or not.

Mitigating climate change

Our climate is not only affected by CO₂. Also other gasses contribute to the greenhouse effect. Especially N₂O (laughing gas). This is a 150 times more potent greenhouse gas than CO₂. It originates, among others, from the use of manure containing nitrogen. Our knowledge is still far insufficient about the nitrogen cycle in soil, water, plants and atmosphere caused by manure, but there are those who fear that intensive manuring (as often required for fast growing crop) has a large climate impact than would be mitigated through the energy use of plants. Until we have a satisfactory answer to this question, it is better to proceed with caution. For complying with our Kyoto commitments, pellets from waste wood are a meaningful (though limited) measure, wood pellets from energy plantations rather not.

Summary

The properties attributed to wood pellets apply in theory, but in practice there are always constraints that limit their potential. Wood pellets will be part of our future energy system, but will probably play a smaller role than expected by many today.

References

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