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PRIMARY ENERGY CONSUMPTION IN BUILDINGS AND THE EMISSION-TRADING-SCHEME: CHANCES FOR THE TIMBER SECTOR?

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ABSTRACT: With the *EU emissions trading scheme (ETS)*, the European Union designed a system which shall achieve the emission targets at minimal cost. To assess the possible impact of the *ETS* on the building sector, and to detect emerging opportunities, a questionnaire was circulated in various branches of the building sector in Germany. Results outlined that at the present time it is not foreseeable how far and to which extent the emissions trading scheme will be introduced in the building sector, including the wood building industry. Therefore an active promotion of wood products with special reference to the plus energy balance of wood and its high portion of renewable energy stored within the material is crucial.

KEYWORDS: Emission-Trading-Scheme, CO²-emission, construction sector, wood building industry, carbon sink

1 EMISSION-TRADING-SCHEME

1.1 FRAMEWORK

The *Kyoto Protocol* is the basic framework for the worldwide reduction of greenhouse gases. As shown in Figure 1, most CO²-emissions per head are produced in First World countries.

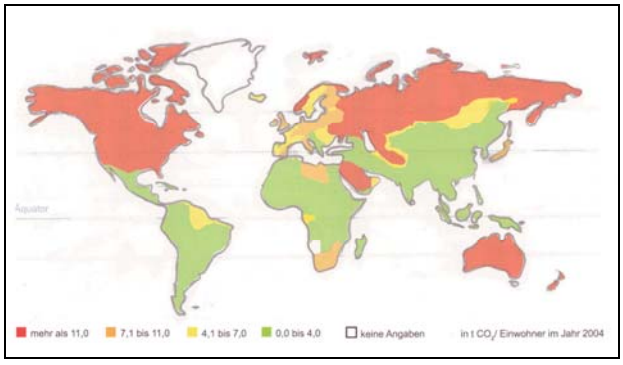

Figure 1: *Distribution of CO²-emission per head of the world population 2004 [1]*

By signing the *EU emissions trading scheme (ETS)* in 2003, the signatory countries conducted themselves to establish a system for greenhouse gas emission allowance trading within the European Community.

This system is designed to effectively achieve the emission targets at minimal cost. The trading of allowances is implemented in two methods: the *Joint Implementation* and the *Clean Development Mechanism*, both incorporating the fact that it is more important that the greenhouse gases will be reduced than the fact where they will be reduced. The latter method also enables Second and Third World countries to reduce emissions and to obtain support (money and knowledge) when implementing these reductions. *Joint Implementation* means that a nation having ratified the *Kyoto Protocol* gives another nation financial support to realize a carbon reduction project and therefore receives the reduced emission rights. *Clean Development Mechanism* supports developing countries to realize carbon reductions by selling emission certificates. Because of lower realization costs in Third World countries it could be reasonable and economically profitable to invest in climate protection in Third World countries.

The emissions trading scheme is managed by the *United Nations Framework Convention on Climate Change (UNFCCC)* and all projects have to be controlled and evaluated through a third party certification process meeting the set of *UNFCCC* quality standards. To get certified, measurable long-term emission reductions have to be realized. These reductions have to be on top of reductions which could be realized through other

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savings, e.g. reductions made only through current (better) technology. It also has to be ensured that certificates are only sold once.

1.2 IMPLEMENTATION

Most of the projects up to date are realized in areas where the largest reduction of emissions per project is possible.

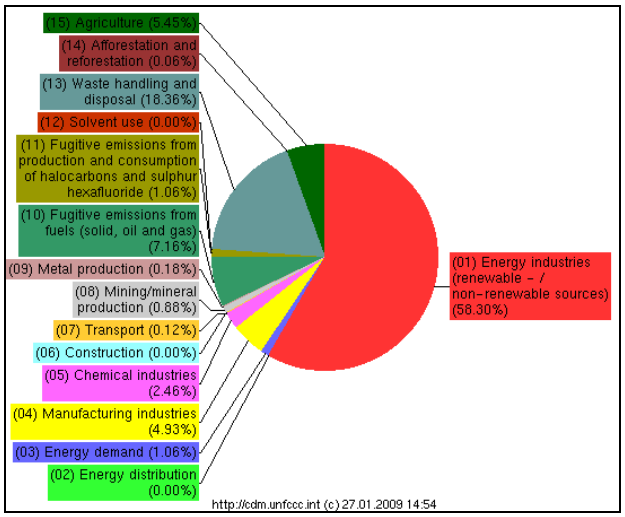

Figure 2: *Distribution of registered projects [2]*

More than the 50 percent of the projects up to date are accepted and realized in the energy sector (use of renewable energy sources e.g. wind parks) as shown in Figure 2 [2], further described in [3]. A few projects are listed in the building materials industry, where reductions are possible through changes in manufacturing processes of energy-intensive building materials (e.g. cement production). In the construction sector itself, there are still very few projects accomplished. This is due to the high amount of reduction still possible in the amendment of energy industry.

One project associated to the building sector (and being certified as a WWF golden Standard project, which includes the fostering of sustainable development) is realized in South Africa. In two Townships in Cape Town (Khayelitsha and Kuyasa), existing homes of low-income population are being energetically upgraded and future homes are designed and built to be energy-efficient. Energy savings are realized through thermal insulation of walls and roof, energy saving lighting and solar collectors for hot water. The project is designed for a period of 21 years. Because of the big amount of homes included in this project and the long timeframe, a reasonable carbon reduction could be realized [4].

2 BUILDING SECTOR

2.1 GENERAL

In the building sector, a huge amount of primary energy and natural resources is needed for the construction of buildings.

In Germany, 30 percent of the greenhouse gases, 40 percent of energy and primary resources and 50 percent of waste accumulation can be attributed to the building sector [5], [6].

Apart from the projects momentarily realized in the energy and building materials industry, there are still various possibilities in reducing this energy impact and increasing the use of renewable materials. The increasing use of wood in the building sector could also help in reducing the greenhouse gases.

2.2 BENEFITS OF WOOD

Building in wood is regarded as climate-neutral. While growing, trees take up carbon dioxide from the atmosphere and store it in the wood as carbon. Therefore wood is regarded as a carbon sink as long as more trees are planted than cut. Sustainable forestry assists in the retention of CO^2 better than leaving the forest untouched. One cubic meter of built-in spruce wood stores 0,69 t CO^2 and substitutes 1,02 t CO^2-emissions of other materials [7].

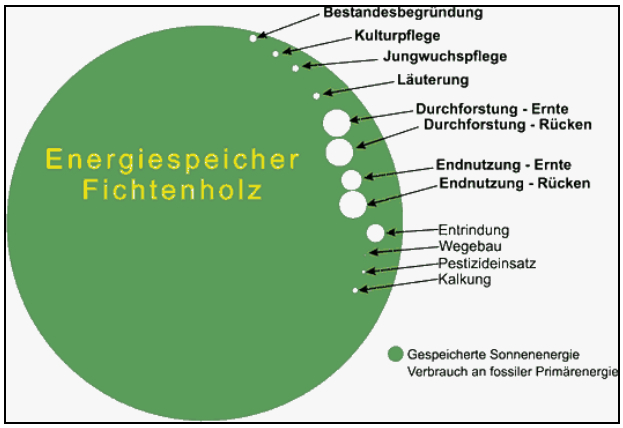

Figure 3: *Energy stored in spruce (green) compared to energy needed for forestry (white) [8]*

The carbon remains in the wood after processing. And, although processing does cause CO^2-emissions, the quantity is usually substantially smaller than the amount locked in the wood. For example, one single family house constructed in timber retains around 40t of CO^2 [9].

2.3 QUESTIONNAIRE

To assess the possible impact of the *ETS* on the building sector, and to detect emerging opportunities, especially for the timber sector, a questionnaire was circulated amongst various branches of construction in Germany in the summer of 2009.

The questionnaire consisted of four pages with thirty three questions. It was send to 120 preselected people of various branches of forestry, wood industry, environmental protection alliance, alliance for the building industry and politicians. The aim was to generate a widespread summary of opinions on how the topic is seen in practice. Questions asked included the

knowledge about energy efficiency and the emission trading scheme, about the impact timber construction could have on carbon reduction and to detect where the chances and potential lie in terms of wood in the building sector. In the end about 37 percent of the questionnaires were returned completed.

2.4 RESULTS OF THE QUESTIONNAIRE

Participating parties belonged to the following groups (see Figure 4).

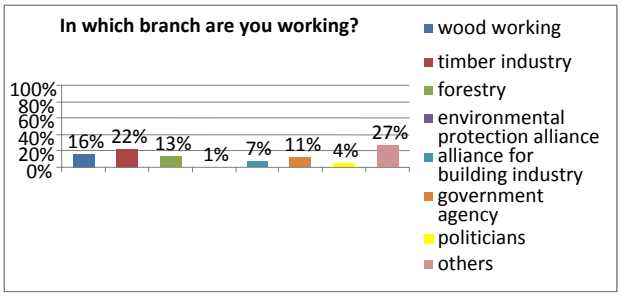

Figure 4: *Branches interrogated with Questionnaire [10]*

The evaluation highlighted the following:

(1) general knowledge in abovementioned areas is low (see Figure 5) but the willingness to acquire more knowledge became evident.

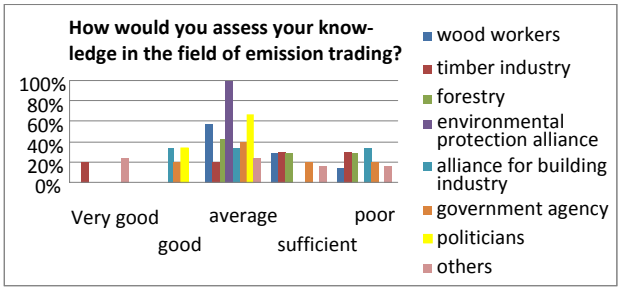

Figure 5: *Personal assessment of knowledge in field of emission trading [10]*

(2) the building sector is assumed to offer the highest possible reductions in energy consumption (see Figure 6).

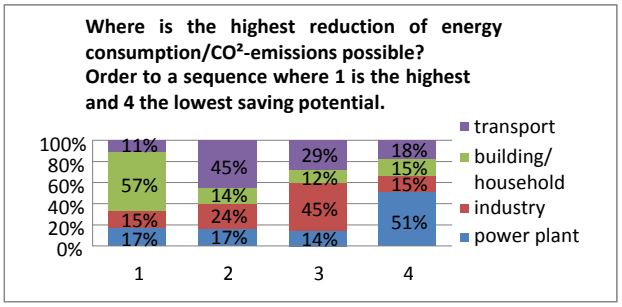

Figure 6: *Ranking of branches in terms of highest assumed energy reduction potential [10]*

(3) energy-efficient renovation is estimated to realize emission reductions in the building sector most cost-effectively. In renovation projects, insulation of walls and roofs is seen as the most effective way to reduce emissions followed by window retrofit and use of renewable sources (see Figure 7).

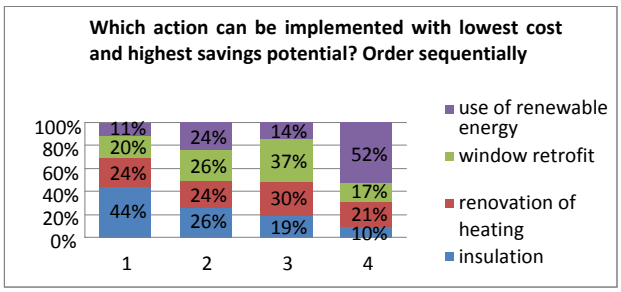

Figure 7: *Assumed renovation-type to realize emission reductions most cost-effectively [10]*

(4) climate protection targets will have a positive impact on the timber sector (stated by nearly 80 % of the respondents, see Figure 8)

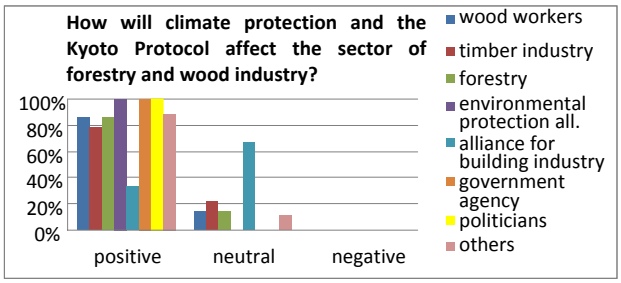

Figure 8: *Assumed effect of climate protection targets on the forestry and wood industry sector*

(5) opportunities seen for the building sector include: increasing use of renewable material, more retrofit of buildings in shorter time, increasing use of timber construction and passive house standard. Especially for the timber sector opportunities where seen if timber marketing promotes its advantages more effectively.

(6) life cycle assessments of all building products should be published in the near future. Wood can be taken in account as a carbon sink project. Therefore wood used must be replanted to store a higher amount of carbon.

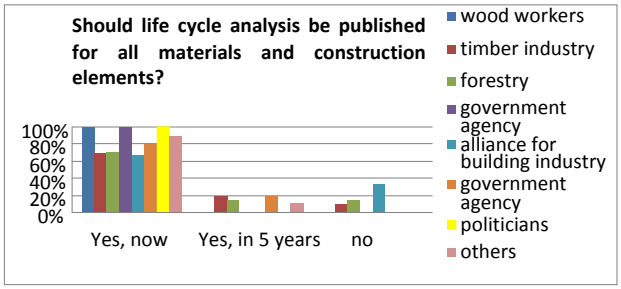

Figure 9: *Attitude towards the publication of life-cycle analyses for construction materials*

3 FURTHER STEPS

It is not foreseeable at the present time how far and to which extend the *emission trading scheme* will be introduced in the building sector, including the timber sector. Therefore an active promotion of wood products is crucial, also addressing the common prejudices against timber constructions (fire protection, durability, end-of-life).
Life cycle assessments and *European Product Declarations* (EPD) for the various wood products should be generated. Hereby the plus energy balance of wood and its high portion of renewable energy stored within the material should be pointed out.

4 CONCLUSIONS

Single construction projects cannot reach the amount of reduction, which can be generated by the projects currently accepted and realized. But factoring the large number of construction projects into these considerations, their immense influence becomes obvious. The fact that the *emissions trading scheme (ETS)* requires ongoing reductions which cannot solely be realized by large projects, will enable smaller projects to profitably participate in the *ETS* in the future. The use of renewable energy for larger housing projects in Third World countries could prove to be good initiating projects. It thereby has to be considered that at the present time, around 80% of CO^2-emissions are produced during the use of buildings while only 20% result from building materials and the building process. Therefore whole life cycle analysis for building construction and operation practice should be used to optimise buildings and reduce environmental impacts in a cost effective way.

ACKNOWLEDGEMENT

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