

Some formal and practical aspects determining the state of wood construction in Poland

Polen als einer der grössten Hersteller von Holzwerkstoffen in Europa

La Pologne compte parmi les plus importants acteurs du bois matériau en Europe

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Growing worldwide awareness of negative impacts of construction processes and use of buildings on the environment and human health and living promote the search for a various ecological material-construction solution. Among the materials with a large ecological positive potential, still undervalued by many communities, is WOOD.

Wood construction is usually understood as the use of wood as a structural material but the use of wood and wood-based materials in construction is much broader. Wood in construction may perform structural functions but wooden windows, doors, stairs, cladding and panelling, floors, terraces and many other wooden products to beautify and enhance the functionality of the interior are commonly used.

In Poland, the final consumption of wood materials, i.e. in the form of finished products (structural elements of houses, wall coverings, windows, furniture etc.) reaches 10 000 000 m³ yearly, where construction is responsible for nearly 60% of the total consumption of wood (Fig. 1). Construction was, is and will be the largest consumer of wood materials (timber and various wood-based materials).

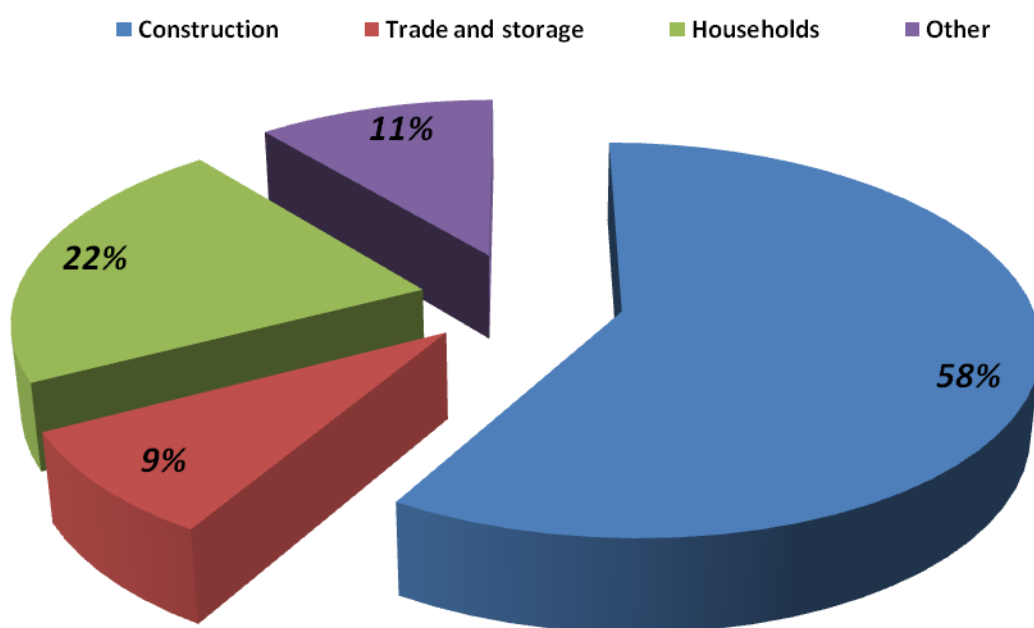


Figure 1: The structure of wood consumption in Poland

Source: E. Ratajczak, A. Szostak, G. Bidzińska, Consumption of wood materials in the economy, Wood Technology Institute, Poznań 2006

One of the major directions is the production of lightweight and durable roof structural elements and also the prefabrication of entire building envelope (walls, floors, roofs) or even whole residential modules. In recent years, the companies prefabricating modern wood frame structures are dynamically developing. A large part of these companies sell their products outside the country. The average Polish investor still prefers other building technologies. There are, however, investors contracting construction of entire housing estate in the technology of prefabricated wood frame (Fig. 2). Unfortunately, wood is being shamefully hidden under the facades made of mineral materials in most of such implementations.



Figure 2: The residential estate near Kołobrzeg built in the technology of prefabricated wood frame

Sets of wooden joinery (Fig. 3) and wooden facades have become more and more popular direction of the use of wood in recent years. About 24% of the total of about 13 million units of windows produced yearly in Poland are wooden windows (data from 2014). For some types of windows, it is even much more (e.g. roof windows). In this industry, there are both, companies with domestic and foreign capital e.g. Scandinavian. In recent years, there has been a retreat from the use of exotic species to native (pine, oak, larch). Prosperity of this industry and other industries for which wood is a basic material is a result of relatively low labour costs combined with a highly qualified technical and management staff and good raw material base. In 2015, Poland took the first place among exporters of windows and doors in the EU.

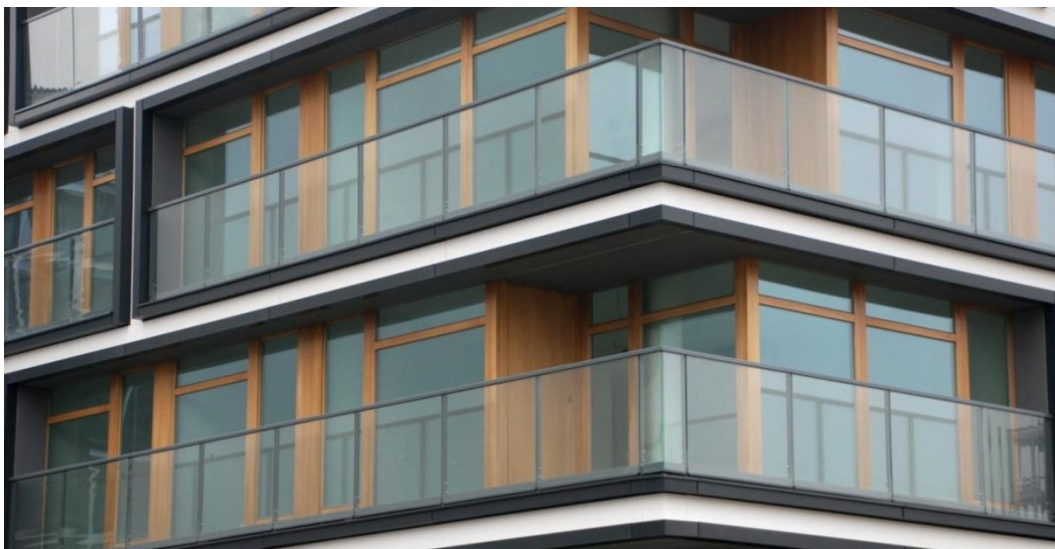


Figure 3: Sets of windows and balcony doors in one of the multi-family buildings in Warsaw

Remarkable aesthetic and technical properties of wood make this material dominant in the production of floors and terraces.

Interior designers more willingly choose wood as an attractive material for internal joinery.

Wood and wood-based panels were and are a basic material for the production of furniture.

Why WOOD should be widely used in construction? Firstly, because it gives almost unlimited possibilities for realizing the vision and creativity of contemporary architects and designers (Fig. 4). There are not too many examples of modern wood construction in Poland. The construction of houses in traditional technologies dominates. Walls of traditional construction native of Podhale may be met throughout the country. Only in solutions of roof structures in hall structures bolder and more interesting use of glued laminated timber is growing.

Secondly, WOOD is friendly to the WORLD because:

- the world's wood resources are not diminishing but growing and it's almost "for free",
- it is the only truly renewable material,
- it is a "storehouse" of carbon dioxide acquired from the atmosphere by trees,
- when the time comes, it can be easily and beneficially recycled or used as a source of "clean energy".

Thirdly, WOOD combines many advantages such as:

- it is both light and mechanically strong,
- it has a good thermal conductivity coefficient,
- it is warm to the touch,
- it almost does not change its dimensions when temperature changes,
- it deadens noise well,
- it is resistant to the effects of destructive chemical substances,
- before it gives in to the destructive forces, it sends a "warning",
- it absorbs the humidity in highly humid conditions, and releases it in very dry conditions, positively influencing interior microclimate,
- it is both durable and resistant to the effect of destructive biological factors when skillfully used,
- it can be easily worked mechanically and it can be modified, as well as relatively easily and inexpensively transformed into other useful structural, insulation or finishing materials.



Figure 4: The original single-family house – “round” house near Pszczyna

The negative characteristics of wood limiting its use in construction are often exaggerated and used by industries based on competing materials. The following features are attributed to wood:

- weak dimensional and shape stability with moisture content changes (swelling, shrinkage)
- relatively high affinity to water and its effects,
- low resistance to destructive impact of biotic and abiotic factors,
- insufficient durability,
- flammability,
- low hardness and abrasion resistance,
- low compressive and tensile strength in direction perpendicular to grain,
- anisotropy of the properties,
- limited availability of dimensions, especially in terms of width and thickness.

It is forgotten, that contemporary wood technology has many ways for total elimination or mitigation of features limiting the use of wood in construction. New innovative technologies of the production of wood-based panels (OSB, MFP) and engineered wood (Glulam, I-beams, LVL, CLT, PSL, OSL) are developed and existing technologies are improved. The use of machine strength graded timber disseminates (MSR). Many ways of improving the characteristics of wood (thermomodification, acetylation, hydrophobization, furfurylation and others) are implemented.

For many years, all over the world the idea of sustainable building as one of the ways to reduce negative human impacts on the environment is being developed.

Wood as one of the few renewable raw materials creates almost unlimited possibilities of realizing the vision and creativity of contemporary architects and designers, including those interested in the development of so-called “green building”.

Coming into force with effect from 1 July 2013, the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 (CPR) laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, introduces a new basic requirement for construction works identified as “Sustainable use of natural resources”. In accordance with this requirement, construction

works must be designed, built and demolished in such a way that the use of natural resources is sustainable and in particular ensure the following: reuse or recyclability of the construction works, their materials and parts after demolition; durability of the construction works and use of environmentally compatible raw and secondary materials in the construction works.

For the purposes of this requirement, broad and multidirectional use of wood and wood-based materials in the construction industry seems obvious. However, watching the market in Poland of faintly developing passive housing and certificates of "green building" one can often get the impression that there is no room for these materials.

Beneficial environmental synergies of use of wood in construction are well reflected in the results of calculation of the amount of carbon dioxide accumulated in the building (Table 1) or in full Life Cycle Assessment (LCA) (Table 2). The results of LCA calculations presented synthetically in Table 2 showing the impact of building technology on the environment clearly indicate the rightness of intensification of the use of wood and wood-based products in construction industry.

Table 1: Carbon dioxide accumulation in an exemplary wooden single-family house (built-up area = 171m²)

No	Component	Product	Quantity	Carbon dioxide accumulation
			m ³	Mg
1	wall framing, ceiling and roof trusses	machine strength graded structural timber	24.5	22.05
2	thermal and acoustic insulation of ceiling	porous fibreboard	7.5	4.50
3	wall sheathing	OSB 3	20.0	28.00
4	Cladding (on the part of the building)	wooden wall coverings	2.8	2.52
5	Flooring and stairs	oak flooring elements	4.2	3.78
6	Wall finishing	pine wood wall coverings (panelling)	1.4	1.26
Total				62.11

Source: Strykowski W., Lewandowska A., Wawrzynkiewicz Z., Noskowiak A. Cichy W. Environmental Life Cycle Analysis (LCA) of wood products, Wood Technology Institute, Poznań 2006.

Table 2: The environmental impact of the construction of single-family house with a usable area of 98m², depending on the type of technology and energy standard (excluding the use phase)

Building type	Ecoindicator [Pt]
masonry, conventional (123kWh/m ² rok)	19.6
masonry, passive (15kWh/m ² rok)	21.6
wooden, conventional (116kWh/m ² rok)	7.5
wooden, passive (15kWh/m ² rok)	12.0

Source: Lewandowska A., Noskowiak A., Pajchrowski G., Strykowski W., Witczak A. Environmental Life Cycle Assessment of model wooden and masonry buildings as an example of LCA application, Wood Technology Institute, Poznań 2012.

Potential of thriving in Poland more and more modern industries based on wood (wood-based panels, sawn timber, windows and doors, floors, furniture) clearly shows that wood construction has a good material base in our country. This potential does not translate, however, to the extent as if it were possible, into increase of the number of completions of residential and other buildings made of wood and wood-based materials.

Key barriers to the development of the Polish construction industry based on wood are:

- habits and distrust of wood of a significant part of Polish society,
- lack of effective governmental and non-governmental programs promoting wood construction,
- lack of statistics (nobody knows how many wooden houses are built in Poland and how many wooden houses are prefabricated in Poland and assembled abroad),
- poor offer of available publications on wooden housing (showing its strengths and weaknesses, containing practical answers),
- lack of educational programs on wood construction (at every level of education),
- lack of national standards for wood construction (real impediment in realization, supervision and commissioning of works),
- despite the visible changes, still relatively small production capacity and poor technical facilities of Polish companies producing and building wooden houses,
- shortage of qualitatively and dimensionally uniform, kiln-dried machine strength graded structural timber, lack of large sawmills specializing in the production of machine strength graded structural timber,
- bad habits and practices in the preparation of wood materials intended for construction,
- too many "bad", and therefore spoiling the market, contractors,
- technical regulations hindering the use of wood,
- shortage of bold and innovative designs and realizations, dominance of traditional building.

Among the factors that should promote wood construction development in Poland are:

- very large and still growing potential and ability to adapt to current market needs of many sectors of wood industry in particular wood-based panels, joinery and flooring,
- creativity and gradual technological development of Polish sawmills,
- ability to make effective use of EU and national aid for the modernization of technical facilities and development of modern, innovative technologies,
- good quality base of domestic wood raw material,
- programs activating cooperation between industry and science,
- openness and ingenuity of many Polish entrepreneurs in business contacts with foreign partners.