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The framed resource efficient lamp design

A man is closely connected with the world at all stages of its development. Since the technical progress has begun to develop, dangerous interference of human beings into the nature has increased dramatically, the amount of the intervention increased. It became so huge that now it is a global threat to humanity. The problem is that the limits of natural resources come closer. Consumption of resources also has increased, more and more materials are used in the industry, and the amount of waste has increased. The solution of this problem is to use the maximum of resources with minimum wastes and to use environmental-friendly materials. It indicates the raise of resource efficiency. Resource efficiency means that fewer resources are consumed for production of a certain volume of products, thereby the amount of waste is reduced. The aim of our work is to design the frame lamp in order to show a way to minimize waste. The problem of resource efficiency is systematically solved.

In this article we would like to consider the resource efficiency on usage of flat-sheet materials: plexiglass, steel, chipboard, plywood, etc. For flat-sheet materials the main parameter of resource is efficient cutting from a prefabricated sheet. You can do it with the help of special programs, such as SolidWorks, Autodesk Inventor, 3D max, Autocad, Compass 3D. The main aim of the project is to obtain the least amount of wastes as well as the lowest cost. The frame lamp was designed in SolidWorks with flat-sheet materials usage in mind. We compared it with the already existing lamp designs. There are different variants of lamps: table and ceiling. At the beginning we decided to design a table lamp that consists of the 10 square frame modules. The optimal type of cutting is the laser cutting. We should think of ease of cutting, productivity, quality of cut before selecting the cutting. One sheet of plywood with dimensions as 25×25×0,5 cm was selected for cutting because this material is not expensive, simple to cut and easy to process. The 10 frame modules are cut by the special machine, each of them is smaller than the previous frame and the area of frame is reduced by 8 cm^2. All modules are fastened with 2 rods: the lower is 3 mm and the upper is 2 mm. The lower rod is attached to the stand 10×10×2 cm. The stand is made of metal, but you can also use other materials such as plastic, wood, glass, etc. Lamp is attached to the hollow lower rod through which the electric wire is routed. Another alternative of construction is a hanging lamp, but the modules are located in several directions and as all ceiling lights it is fastened by a hook. Square modules are placed under each other, but not a chaotically. It doesn't depend on the type of a lamp. We can use different materials for the frame construction: metal, plastic, glass, plexiglas, plywood, etc. In order to show that the structure has a small percentage of wastes in comparison with other lamps a pendant lamp is taken for comparison. The design consists of 15 square wooden frames 10×10×1 cm and chrome-covered rods, inner dimensions are 6×6 cm. There is also a platform on which modules are attached to framework 60×10×3,5 cm. The volume of the original plywood is cut out of the modules with volume 1500 cm^3. The final result of the comparison is that the material wastes are 540 cm^3, it means 36 % from all the flat-sheet material. Also we have calculated the percentage of material wastes from all-plywood sheet for production of another ceiling lamp. The construction of the luminaire consists of 36 modules in the form of a half-square frame, the size of which is 20×3×28 sm. The area of the original sheet of plywood with a width of 0.3 cm is 20160 cm^2. The final result of the comparison is that the material wastes are 13464 cm^2 area and that 66 % of the total material wastes. Details are the same size and number as framework modules. The volume of the original wooden sheet is 312.5 cm^3, 12.5 cm^3 of material wastes, that is 4 % of the total material volume. It means that the amount of material wastes are reduced approximately by 13 times.

In conclusion, we mention the importance to achieve resource efficiency. The effectiveness of this method is demonstrated by the example of lamps. If we choose the economical cutting, we can achieve the best effect. The main purpose of engineers and designers is to create such a construction which spends less resources and generate less waste. Improving resource efficiency helps the state of the environment. This method has little influence on the ecological, unreasonable consumption of resources, not slows the growth of the economy, but may have a significant impact on a particular company that focuses on resource efficiency. There's a «boomerang effect» an economic term when consumers invest in the purchase of additional equipment for increasing domestic comfort by increasing the overall consumption of resources. Resource efficiency can`t solve global problems, but it can help to save resources.

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