

## **Wood fuels in Southern Germany: Identification and analysis of representative supply chains and resulting effects for rural regions in Baden-Württemberg**

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### **Abstract:**

**Background and purpose.** Wood-fuel becomes more and more important not only as an additional income for farmers and private wood-owners but also for regional power and heat supply. A considerable amount of wood is collected and processed directly by end users already today. To satisfy the future demand of wood fuel the number of employees in forestry is expected to increase. Different studies are concluding that there exists an overall technical potential of 66 PJ/a in Baden-Württemberg, when using all kinds of available energy wood such as various wood residues from forestry, minor qualities of wood logs or general surpluses in forestry between growth and annual extraction. Less than half of it is presently used. One third of it is built by forestry residues wherefrom only 40 % are presently used. The rest is left in the forests.

A prediction of potential small and medium term employment effects caused by increased use of wood fuels is of considerable interest for regional development planning. A methodological approach for this kind of employment assessment is presented by this study, including selected results from application on the federal state Baden-Württemberg.

**Methodological approach.** Data on potential wood fuel amounts build the basis of the assessment. Further more, a characterisation of typical supply chains for wood-fuels, the involved equipment and the required manpower was conducted. Different forms of wood energy fuels and supply logistics require specific levels of mechanization. They also have specifically different outputs of wood fuel per involved working hour. To be competitive with fossil fuelled energy systems the supply chains for wood fuels have to be optimised, but with special regard to local conditions as well as end use requirements (e.g. quantities of demand, required general and specified fuel properties as there are size, moisture content, else). However, each supply chain regarded as typical can be considered as representative for the supply of a specified amount of presently or in future used wood fuel of any property. By this means quantities of wood fuel extraction can be approximately converted into potential employment in agriculture and forestry.

The supplementary demand of manpower for construction and maintenance of wood-fuel energy systems, compared to fossil energy systems was assessed as well. It was calculated using the differences in prices between the readily usable biomass energy units compared to light oil or natural gas combustion units; higher prices were interpreted as additional required labour costs for production and installation respectively.

As completion the regional income effects of increased wood energy use were analysed. Income effects consist of direct income effects, which are the salary of the new employees, reduced by higher costs of wood-fuel energy systems, and of indirect income effects. The indirect effects are caused by the satisfaction (above all production, services) of the new employees' demand.

**Results and innovation.** Advantages and disadvantages of man-power based systems and systems with high degrees of mechanization (e.g. costs of supply, subdivided into machinery-costs and employee-costs, required manpower and machinery use per m<sup>3</sup> of wood chips) are shown. By connecting shares of the available wood potentials to the typical supply chains defined above, labour requirements of today's use as well as of future increased use of wood fuels were derived. By defining an average annual labour time even the amount of potentially new jobs in agriculture and forestry connected with increased wood fuel supply was estimated. From the assessment of wood fired combustion devices and their average prices the additional labour requirements compared to fossil fuelled systems were approximated for Baden-Württemberg. Finally, the resulting income effects were calculated from the figures gained before.