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A NEW APPROACH FOR BIOMASS POTENTIAL DETERMINATION – A CASE STUDY FOR THE CZECH REPUBLIC

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1. Overview

Biomass currently plays decisive role in renewable energy sources (RES) portfolio in EU. National Renewable Energy Action Plans of EU member states assume further growth of biomass utilization by 46% (in absolute terms). Biomass plays also significant role in power generation based on RES utilization – currently (2010) about 18% of the total electricity generation from RES is based on biomass in all its forms (164 TWh in total) and power generation based on biomass is expected to growth by more than 100% (232 TWh) in 2020. Also biomass utilization for heating and cooling is expected to growth by 46% (in absolute terms) between the years 2010 and 2020.

Similarly as in the EU as a whole, biomass plays an important role in the energy strategy of Czech Republic. Biomass is by far the decisive RES both in heating and cooling (app. 97% of total RES consumption) and power generation (app. 40% of the total power generation based on RES in 2010). NREAP of the Czech Republic is expecting the further growth of biomass utilization for power generation till the year 2020 (up to 53% contribution to the whole RES power generation) and keeping the decisive role on RES consumption for heating and cooling.

Strategies of EU and of the Czech Republic assume further massive development of RES utilization and biomass is expected to keep the key role in total RES contribution. Preparation of effective strategies of biomass development for energy purposes (including cost effective scheme of biomass support) on national and EU levels requires among other objectives (unbiased) determination of biomass potential with regard to the agriculture land utilization, dynamic aspects of biomass potential development and also with regard to the national and EU strategies of food production.

This paper presents methodologies used for biomass potential determination and in detail analysis of biomass potential development for the Czech Republic under the condition of cost effectiveness.

2. Method of approach

The paper presents an approach used for the determination of biomass potential with special focus on linking the total biomass potential and the area of agriculture land used for energy crop under the boundary condition of cost effectiveness. The development of the biomass potential should be further understood with its time dynamics resulting in possible speed of (new) energy crop penetration into massive scale.

The paper presents the methodology currently developed for biomass potential determination in the Czech Republic as the example of approaches based on high resolution spatial data. The methodology utilizes the information from soil and climate condition evaluation of plots of agriculture land and also the yield curves of individual kind of energy crop (e.g. SRC plantation, reed canary grass, etc.) and conventional crop (for determination of straw energy potential) for the soil and climate conditions of particular land. Each yield curve is accompanied with the information on so called minimum price of biomass (bottom acceptable price of biomass ensuring the adequate economic profitability to the biomass producer).

In detail the methodology enables the determination of biomass potential allocation assuming the “optimum” allocation of conventional and energy crop according the soil and climate parameters of land. Our methodology also assumes the priority of conventional crop (for food production) which means that energy crop utilize agriculture land with lowest yields for conventional crop. Higher (relative) allocation of agriculture land for energy crop continuously leads to the utilization of higher quality land also for energy crop which results in non proportional growth of biomass potential. This methodology leads to the calculation of the “conservative estimate” of biomass potential for energy purposes.

3. Results

The major results of this analysis are: (i) Total future biomass potential reaches 164 PJ in the case of a “100% food security” scenario with 30% of agricultural land allocated for new energy crops under the condition of cost-

effectiveness; (ii) Another major result of our analysis is that the increase of biomass potential is not directly proportional to the increase of arable land used which is caused by different climate and soil requirements and decreasing yields of energy crops on allocated land, e.g. planting poplar and willow in colder climatic regions. The dependence of the total potential of biomass on the area of agricultural land in the Czech Republic is shown in Fig. 1. An interesting effect is that the increased area allocated for energy purposes decreases the energy potential of residual straw.

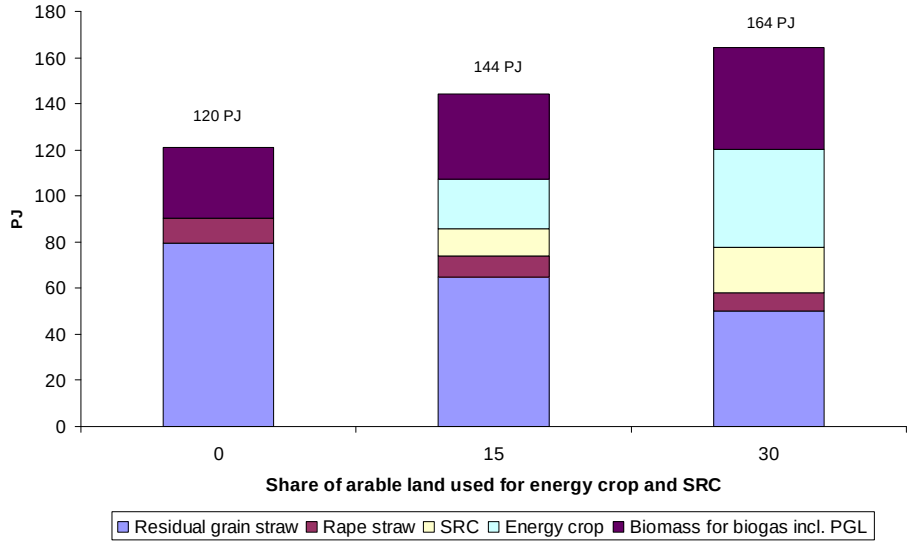

Fig. 1. Long term sustainable and cost-effective biomass potential in the Czech Republic as a function of arable land used for energy crops

4. Conclusions

The preparation of an effective strategy of the biomass development for energy purposes on national and EU levels requires among other objectives (unbiased) determination of the possible development of biomass potential. The major conclusion from this analysis is that the methodology used – based on detailed spatial data and using GIS tools – can significantly contribute to refine the potential of biomass and its economic attractiveness. The results obtained provide a reliable source of information for policy making at national as well as at regional level.

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