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Policy Note

International Trade of Bio-Energy Products – Economic Potentials for Austria

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Abstract

TRIOPOL studies the role of domestic bioenergy potentials for agriculture, the wider economy and international trade for Austria. In particular, agricultural biomass production can contribute to significant shares of energy provision in Austria. A detailed scenario is developed to explore the opportunities and challenges of enhanced domestic biomass production based on short rotation forestry (SRF) for heat supply which is currently among the most competitive technologies. To that end, TRIOPOL establishes a model linkage between a sectoral supply-model for Austrian agriculture and a national small open economy general equilibrium model. Model results show that a biomass premium of 65 € per ton dry matter is required to support 250,000 ha of SRF on cropland in Austria by 2020. The thus provided bioheat covers some 33 petajoule (PJ) heat energy demand in Austria; taking into account the likely rising of energy prices by 2020, this number rises to 47 PJ. Substantial land use changes may also be compensated by increases in land use intensity and as well as changes in imports and exports. Scenario results suggest that domestic food production of non-meat commodities falls by 1.3%. The sector meat products profits from the high competitiveness of Austrian livestock production and responds by a slight increase in net exports. The results of the quantitative analysis shall support the scientific and political debate on securing food and energy supply as well as economic development goals.

Keywords: Bioenergie, Landwirtschaft, Nahrungsmittelproduktion, Landnutzung, Wärmebereitstellung, Außenhandel, Modellstudie, Modellkopplung

JEL-codes: C63, C68, E20, F10, Q18, Q21, Q42

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International Trade of Bio-Energy Products – Economic Potentials for Austria

Policy Note

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The study 'International Trade of Bio-Energy Products – Economic Potentials for Austria' (TRIOPOL), firstly, has assessed the Austrian bio-energy potential based on an extensive literature review. Secondly, the complexity of the research questions and the need for quantitative assessments to support policy decisions suggest the application of a model cluster. Therefore, TRIOPOL has established a model linkage between a sectoral supply-model for Austrian agriculture and forestry (PASMA) and a national small open economy model (CGE model). A detailed scenario has been developed to study the impacts of additional domestic agricultural biomass production on the sector, economy and trade balance. In addition, TRIOPOL provides further (qualitative) insights into domestic production potentials and the opportunities of sparing land for biomass production in Austria. The study highlights the importance of scientific assessments of economic and natural/technical bio-energy production potentials. The results of the quantitative analysis shall support the scientific and political debate on securing food and energy supply as well as economic development goals.

An extensive scientific literature review on agricultural biomass potentials for energy production in Austria revealed the state of the art in methods, the underlying assumptions and data, and related uncertainties, as well as the most promising biomass crops, range of potentials, and bio-energy conversion pathways. Studies mainly differ by their aims, i.e. whether to provide a technical and natural science perspective on biophysical production potentials, or an economic perspective that takes competition among alternative land uses and along the supply chain into account. Even in economic potential analysis, studies can range from a straightforward comparison of gross margins among alternative crops to integrated market models that take into account feedbacks from other sectors and regions as well as alternative land uses. Despite the current use of forestry biomass for heating, studies show that agricultural biomass production can contribute to significant shares of energy provision in Austria (cf. SCHMIDT et al. 2011a). As most competitive technologies appear short rotation forestry for heat supply as well as crop residues such as straw (cf. e.g. TRINK et al. 2010). With the development of industrial scale 2nd generation biofuel production, its potential may even increase. However, land demand in Austria would be considerable ranging between 200,000 to 300,000 ha, although no substantial free land resources are available. Most land is utilized for domestic food, feed, and bio-fuel demand and trade.

TRIOPOL applied an integrated model cluster to answer questions on domestic bioenergy production and implications for the economy and trade. Thus, a detailed scenario has been developed to explore the opportunities and challenges of enhanced domestic biomass production based on short rotation forestry (SRF). The scenario is very specific and investigates the potential of pellets based on SFR to be used for domestic heat production. Impacts of the scenario are studied for Austrian agriculture and the use of cropland as well as for the wider economy and international trade. In the scenario, a biomass premium of 65 €/tDM is required to support 250,000 ha of SRF on cropland in Austria by 2020. This leads to shifts among agricultural crop sectors and a hardly impacted livestock sector. While grain, oil crops, and legumes decrease in production values, the OCR sector including SRF is increasing considerably. Sub-

stantial land use changes such as those assumed in the scenario likely impact prices on factor endowments (e.g. land) as well as of other crops even in a small open economy such as Austria. The three largest agricultural sectors respond by +1.3% (vegetables and fruits), -0.8% (bio-energy and fodder crops) and -1.4% (livestock industry) price changes. It has been shown by our model results as well as other studies (cf. STÜRMER et al. 2013, SCHMIDT et al. 2012) that such substantial land use changes may also be compensated by increases in land use intensity and changes as well as in imports and exports. Leakage of bio-fuel production has been sufficiently documented in the scientific literature. Therefore, policy makers need to take into account such inter-linkages, if they want to contribute to sustainable land use systems on a global level. This latter perspective is required to tackle global change phenomena such as support of an increasing world population in numbers and affluence, climate change, or conversion of pristine natural areas of highly ecological value.

Results from the sector model also show interesting trade-offs between SRF and straw production. Production potentials of straw appear considerable in Austria according to the scientific literature and authors praise its limited land use conflicts as a crop residue. However, straw production is complementary to grain production and thereby is in competition to SRF. Furthermore, straw is already utilized for livestock housing and feed as well as maintaining soil fertility. However, decreasing grain areas such as in the scenario of this study may turn the Austrian straw balance even negative. Model results indicate a substantial though not unlimited resource, which may be affected by land use policies despite its residue-character. This shall be taken into account by businesses which utilize straw for insulation of buildings and technology development on 2nd generation agro-fuels.

Under the specific scenario assumptions for the level of premiums necessary to supply the target SRF amounts, the biomass supply extension generates pellets based SRF worth some 157 million EUR, and biomass heat services worth some 740 million EUR. The provided bio-heat covers some 33 PJ heat energy demand in Austria. Taking into account the likely rising of energy prices by 2020, this number may rise to 47 PJ. Assuming that final Austrian energy demand will have increased to 1,400 PJ until 2020 (business as usual assumption), this amount (47 PJ) would serve some 3.4% of final energy demand. If final energy demand can be stabilized at 2005 levels (1,100 PJ, cf. Energy Strategy for Austria, BMLFUW and BMWFJ), some 4.3% of final energy demand could be covered. Taken as shares in final energy demand for household heating and cooling as well hot water boiling, bio-heat would satisfy some 11.1% and 14.1% of energy demand, respectively.

Changes in the biomass and agricultural markets are transmitted to other inter-linked sectors in the economy. Adjustments also occur in terms of trade balance changes, since, in a global world, goods and services are produced both for domestic and export markets, while domestic shortages may be compensated for by imports. The food sector is the most important downstream industry of agriculture and an important upstream industry (animal feed), and thus responds most strongly to a shift in agricultural supply levels.
Scenario results suggest that domestic food production of non-meat commodities falls by 1.3% as a reaction to the output decrease in crop sectors and translates from a

moderate net exporter to a week net exporter. The sector meat products, by contrast, profits from the high competitiveness of Austrian livestock production and responds by a 1.8% increase in domestic production together with a slight increase in net exports. In terms of trade intensities, the sector meat products exports more intensively (exports relative to domestic production), whereas non-meat products import more relative to domestic production levels. Compared to the prices of other consumption goods, domestic prices of non-meat food rise while those of meat products fall. Furthermore, for the specific sector that comprises energy crops the trade balance remains negative.

Leakage of part of the food production, however, may be problematic because it relocates value chains to other countries. By contrast, imports of agricultural goods have not that strong implications for value added because of their further domestic processing. Thus, fostering international trade to develop a global bio-energy market is critical for the utilisation of bio-energy potentials worldwide as well as to overcome national constraints on land resources.

The competition of domestic land between biomass products and crops for food supply is a key challenge in the management of energy and food security. Trade-offs between biomass production for energy supply and food become even more obvious. Policy decisions aiming at increasing the value-added of national production and gains from trade therefore should take this into account.

From a public budget perspective, additional public spending is required when domestic biomass potentials are activated by the introduction of biomass premiums or by directly subsidizing biomass heating technologies. Premiums for SRF may be partially financed (20%) by other funds, such as the agri-environmental budget, because SRF is not eligible to these funds under current policies. With respect to its environmental effects, advantages of SRF such as limited soil disturbance and provision of landscape structure must be contrasted to likely increasing land use intensities and decreasing aesthetic landscape values in regions with high shares of SRF. Further scientific analyses are required to balance these effects under future energy policies and economic development.

Additional bio-heat production based on SRF requires production resources and is particularly dependent on the availability of land. One way of increasing domestic biomass-supply might be achieved by providing appropriate subsidies (as shown within the modeled scenario). In such a situation, farmers are incentivized to switch from crop production to SRF. Another way of releasing land for alternative uses is the management of the food demand. Food waste is considerable in industrialized countries and a reduction may create a number of welfare effects on household income and resource use. Considering the fact that 84% of agricultural land is needed for animal products (cf. ZESSNER et al. 2011), a reduction in overall consumption of livestock products could help to release land resources. Changes in diets are often considered as means to more sustainable food systems (FOLEY et al. 2011). However, such changes need to be considered on continental to global scales in order to prevent leakage and rebound effects. Hence, reducing food waste and supporting changes to more sustainable and healthy diets are cross-cutting political issues of high priority to increase the sustainability of today's economic system.