

Prediction of energy cropping trends in some EU countries

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Keywords: alternative energy sources, biofuel, mathematical model, logistic function

Introduction

The governments of the member countries of the European Union committed to decrease the greenhouse gas emission assumed to increase the alternative energy source cropping on lands, which rises the competition for this resource between the food or feed and the energy plants. There are different forecasts about the food price changes (e.g. according to Collins (2008) or Mitchell (2008) rising, but according to Popp – Potori (2008), Baffes – Haniotis (2010) or Popp et al. (2010)) there is not significant effect because of the rise of the share of the alternative energy cropping in land use. According to the statistics, the characteristics of the growth of the energy cropping were different during the last decade in the member countries. The research aim was to identify the parameters of the trends by non-linear regression model. Based on the results of Járási [2009] one of the most acceptable method for estimation of the future alternative energy production is the logistic function because of the general experience of „the trees do not grow until the sky”.

Materials and methods

During the research the timeline series of biofuel production from 2004 to 2015 of the EUROSTAT database was used. Seven countries of the EU were analysed by the model, and that countries were the first six countries with highest biofuel production in the EU (i.e. Germany, Spain, France, Italy, the Netherlands, Sweden) and the seventh was Hungary for a positioning and a comparison. For timeline analysis the Verhulst-type logistic function modified by Hunyadi (2004) (see Járási, 2009. 5. p.). was used with a further modification by introducing a Δt . The formula is the following:

$$y_t = \frac{k}{1 + \exp[\beta_0 + \beta_1 \cdot (t_i - \Delta t)]}$$

where k is the impregnation parameter (saturation level); β_0 is shifting parameter, when everything is constant it shifts the curve to the right; β_1 is shape parameter, its growth makes the function steeper (in absolute value); t_i is an element of the timeline and Δt is time lagging. The parameters of the functions were estimated by heuristic method with stepwise refinement.

Results and discussion

The estimated parameters of the logistic functions for prediction of biofuel production are presented in Table 1. The correlation coefficients suggest that most of the estimation of parameters results strong correlation between the timelines and the value of predictor functions. By replacement of the parameters into the logistic function it could be explored that in case of Germany, France and Sweden the production is close to its predicted

maximum (see relative change of the predicted biofuel production from 2014 to 2015). In the other analyzed countries the growth of the biofuel production decreases.

Table 1 Parameters of the predictions by logistic functions for forecast the biofuel production in some EU countries

Country	k (in ktoe)	β_0	β_1	Δt (in year)	r^2	Relative change from 2014 to 2015 (in %)
Germany	3400	-1.5	1.0587	5.0	0.9460	0.00
Spain	1200	-0.6	1.0202	2.0	0.8956	0.68
France	2500	-0.9	1.0618	3.5	0.9737	0.03
Italy	900	-0.6	1.0202	2.0	0.7240	0.68
the Netherlands	1500	-1.2	2.7183	0.0	0.9744	0.47
Sweden	350	-0.6	1.0513	5.0	0.7323	0.12
Hungary	400	-0.6	1.0100	0.0	0.9537	2.21

ktoe = kilotonne of oil equivalent

Conclusions

The energy cropping (i.e. biofuel production) is mainly a political issue because of its environmental, energy policy and agro-policy aspects. Different reasons drive the decisions about rising the production and utilization of the biofuels in the different countries. The predictions suggest that the first generation of biofuel production will not grow considerable in the European Union yet. This conclusion is confirmed by the directive of the Council of the European Union in 2017, which limits the share of the first generation of biofuel production in 7%, at the same time it inspires for the production of biofuel production by developed technologies because of the reduction the direct changes in the land use.

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