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MODELLING CO2 EMISSIONS IMPACTS ON CROATIAN POWER SYSTEM

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ABSTRACT

Today's electrical energy landscape is characterized by new challenges such as deregulation, liberalization of energy markets, increased competition, growing demands on security of supply, price insecurities, and demand to cut CO2 emissions. All mentioned challenges are calling for consideration of various options (like nuclear, coal, gas or renewable scenarios) and for better understanding of energy systems modelling in order to optimize proper energy mix. Existing models are not sufficient any more and planners will need to think differently in order to face these challenges. European emission trading scheme (EU ETS) started in 2005 and it has great influence on power system short term and long term planning. Croatia is obliged to establish a national scheme for trading of greenhouse gas emission allowances from the year 2010, which will be focused on monitoring and reporting only until accession to EU when it will be linked with EU ETS. Thus, for Croatian power system it is very important to analyze possible impacts of CO2 emissions. Analysis presented in this paper was done by two different models: mathematical model, based on short run marginal costs (SRMC, relevant for fuel switch in existing power plant and merit order change) and long run marginal costs (LRMC, relevant for new investment decisions); and electricity market simulation model PLEXOS, which was used for modelling Croatian power system during development of the Croatian energy strategy in 2008. Results of the analysis show important impacts that emission trading has on Croatian power system, such as influence of emission price rise on price of electricity and on emission quantity, and changes in power plants output that appear with emission price rise. Breakeven point after which gas power plant becomes more competitive than coal is 62 €/tCO2 for SRMC and 40 €/tCO2 for LRMC. With CO2 prices above 31 €/tCO2 wind is more competitive than gas or coal, which emphasizes importance that emission price has on competitiveness of renewables.

KEYWORDS

emission trading, modelling, power system planning, optimization, generation expansion

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