

The Potential of GHG Emissions Reduction in Macedonia by Renewable Electricity

Boris Čosić^{1*}, Natasa Markovska², Verica Taseska², Goran Krajačić¹, Neven Duic¹

¹Department of Energy, Power Engineering and Environment, University of Zagreb,
Faculty of Mechanical Engineering and Naval Architecture, Ivana Lučića 5, 10002
Zagreb, Croatia
Boris.Cosic@fsb.hr

²Research Center for Energy, Informatics and Materials, Macedonian Academy of
Sciences and Arts, Krste Misirkov 2, 1000 Skopje, Macedonia

The energy sector in Macedonia is the main emitter of greenhouses gases (GHG) with share of about 70 % in the total annual emissions (12 – 14.5 Mt CO₂-eq). Furthermore, within the energy sector, 70-75 % of emissions are associated with the electricity generation due to the predominant role of the lignite fuelled power plants. This makes the electricity sector the most significant key source and, at the same time, the main target for GHG emissions reduction. The main goal of this paper is to assess the potential for GHG emissions reduction by increasing the use of renewable energy sources (RES) for electricity generation. For this purpose a RES scenario for the power system expansion is developed by making use of EnergyPLAN model. The maximal penetration of wind and solar energy results in reduction of the GHG emissions from the reference scenario for 8.26 %. Total investment needed for realization of this option is estimated to 800 M€. Furthermore, the RES technologies are analyzed from economic aspect and combined in a form of emission reduction cost curve, displaying the total marginal cost of the GHG emissions reduction by renewable electricity.

1. Introduction

At the moment, the most critical issues in European energy sector are security of supply and GHG emissions. One of the most promising solutions for alleviation of energy import and diversification of the energy resources, which at the same time reduce the GHG emissions are renewable energy sources. Hence, the common goal of the European Union is to increase the share of RES into final energy consumption to 20 % in 2020 and to reduce GHG emissions by 20 % until 2020 in comparison to their levels in 1990 and by 30 % until 2030 if the other developed countries undertake similar steps. The main problem of RES, except biomass, is their intermittent nature, so in order to use them effectively it is necessary to have energy storage in the system (Krajačić et al. 2009). Because of the high investment cost in the storage systems usage of the RES is becoming even more expensive (Krajačić et al. 2010).

In the case of Macedonia, energy production is based mainly on the low-quality domestic lignite, biomass, mainly for space heating and hydro. The share of other than hydro and biomass RES is very low. In recent years, the increasing electricity demand

