

Life cycle assessment of residual forestry biomass chips at a power plant: a Portuguese case study

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Abstract The residual forest biomass (RFB) sector has been experiencing strong development at European level and particularly in Portugal mainly due to the increase of energy production from renewable sources. The aim of this study is to assess the environmental impacts of eucalyptus RFB chips production chain in Portugal. The environmental and economic impact comparison of the processes included in the production chain is presented as well. The environmental impacts were calculated by the life cycle assessment approach described in the ISO 14040 series of standards. The production chain assessed included all processes from eucalyptus forest until the delivery of RFB chips at the power plant. The main conclusion of this study is that eucalyptus wood production is the process that presents the greatest environmental impact through the product life cycle. Considering only emissions and depletion of energy resources, RFB chipping is the process that presents the higher environmental impact followed by transport of RFB by truck and trailer and transport of RFB by forwarder. These operations are responsible for approximately 81 % on “Respiratory inorganic” and 87 % on “Fossil fuels” which are the two most significant normalized impact categories. In economic terms, the transport of RFB by truck and trailer presents the highest cost followed by chipping and processing of trees. These three operations are responsible for approximately 80 % of total

costs. A sensitivity analysis showed that a 32 % increase in the transport distance from the forest to the power plant would cause an 8 % increase in “Climate change”.

Keywords Forestry · Life cycle assessment · Renewable energy · Residual forestry biomass · Wood energy

Introduction

The sustainable use of residual forestry biomass (RFB) (branches and tops) to produce electricity and heat is a good alternative to the use of fossil fuels because its burn is neutral in terms of CO₂ emissions into the atmosphere and thus contributes toward reducing global warming.

To reduce greenhouse gas emissions within the Community and comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change, and with further Community and international greenhouse gas emission reduction commitments, and reduce its dependence on energy imports, the European Community approved the Directive 2009/28/EC [1] on the promotion of the use of energy from renewable sources. According to Annex I of this Directive, Portugal shall ensure that the share of energy from renewable sources in gross final consumption of energy in 2020 is at least 31 %. Such mandatory national overall targets are consistent with a target of at least a 20 % share of energy from renewable sources in the Community’s gross final consumption of energy in 2020.

To be able to achieve the national objectives set out in this Annex, in recent years, several power plants were built in Portugal whose fuel is RFB. According to the statistical data [2], the total installed power in biomass power plants (without cogeneration) increased from 24 MW in 2008 to

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