



Energy efficiency improvements in ammonia production—perspectives and uncertainties

Islam Rafiqul*, Christoph Weber, Bianca Lehmann, Alfred Voss

*Institute of Energy Economics and the Rational Use of Energy (IER), University of Stuttgart,
Hessbruhl Str. 49a, 70565 Stuttgart, Germany*

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Abstract

The paper discusses the energy consumption and energy saving potential for a major energy-intensive product in the chemical industry—ammonia, based on technologies currently in use and possible process improvements. The paper consists of four parts. In the first part, mainly references to various ammonia production technologies are given. Energy consumption, emissions and saving potentials are discussed in the second part. Thereby, the situation in Europe, the US and India is highlighted and various data sources are compared. In the third part of the paper, a novel approach for modeling energy efficiency improvements is described that accounts for uncertainties and unobserved heterogeneity in the production processes. Besides new investments, revamping investments are also included in the modeling and the development of the production stock is accounted for. Finally, in the fourth part, this approach is applied to the modeling of energy efficiency improvements and CO₂ emission reductions in ammonia production. Thereby, considerable improvements in specific energy use and CO₂ emissions are found in the reference scenario, yet under the assumption of high oil and gas prices, a partial switch to coal based technologies is expected which lowers notably the CO₂ efficiency. Introduction of a CO₂ penalty under a certificate trading or other regime is on contrary found to foster energy efficiency and the use of low carbon technologies. © 2005 Published by Elsevier Ltd.

1. Introduction

Ammonia is a chemical base product and used for multiple purposes, including fertilizer production. Worldwide ammonia production capacity is indicated in Table 1 [1], which shows that the production capacity remains almost constant for the last 3 years in most of the regions of the world, except Asia.

* Corresponding author. Tel.: +8802 716 8992; fax: +8802 861 5583.

E-mail address: rafi@udhaka.net (I. Rafiqul).

