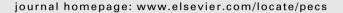


Contents lists available at ScienceDirect

Progress in Energy and Combustion Science





Effects of technological learning on future cost and performance of power plants with CO₂ capture

Machteld van den Broek a,*, Ric Hoefnagels , Edward Rubin b, Wim Turkenburg A, André Faaij a

a Department of Science, Technology and Society, Copernicus Institute for Sustainable Development and Innovation, Utrecht University, 3584 CS Utrecht, the Netherlands

ARTICLE INFO

Article history: Received 23 February 2009 Accepted 8 May 2009 Available online 1 July 2009

Keywords:
Technological learning
Experience curve
CO₂ capture
PC plants
IGCC plants
NGCC plants

ABSTRACT

This paper demonstrates the concept of applying learning curves in a consistent manner to performance as well as cost variables in order to assess the future development of power plants with CO2 capture. An existing model developed at Carnegie Mellon University, which had provided insight into the potential learning of cost variables in power plants with CO₂ capture, is extended with learning curves for several key performance variables, including the overall energy loss in power plants, the energy required for CO₂ capture, the CO₂ capture ratio (removal efficiency), and the power plant availability. Next, learning rates for both performance and cost parameters were combined with global capacity projections for fossil-fired power plants to estimate future cost and performance of these power plants with and without CO₂ capture. The results of global learning are explicitly reported, so that they can be used for other purposes such as in regional bottom-up models. Results of this study show that IGCC with CO2 capture has the largest learning potential, with significant improvements in efficiency and reductions in cost between 2001 and 2050 under the condition that around 3100 GW of combined cycle capacity is installed worldwide. Furthermore, in a scenario with a strict climate policy, mitigation costs in 2030 are 26, 11, 19 \in /t(excluding CO₂ transport and storage costs) for NGCC, IGCC, and PC power plants with CO₂ capture, respectively, compared to 42, 13, and 32 €/t in a scenario with a limited climate policy. Additional results are presented for IGCC, PC, and NGCC plants with and without CO₂ capture, and a sensitivity analysis is employed to show the impacts of alternative assumptions on projected learning rates of different systems.

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^b Department of Engineering and Public Policy, BH 128A, 5000 Forbes Ave, Carnegie Mellon University, Pittsburgh, PA 15213, USA

^{*} Corresponding author. Tel.: +31 302532216; fax: +31 302537601. *E-mail address*: m.a.vandenbroek@uu.nl (M. van den Broek).