



A review of efficiency penalty in a coal-fired power plant with post-combustion CO₂ capture



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HIGHLIGHTS

- Recent studies on the efficiency penalty of a coal-fired power plant with CCS are reviewed.
- The effects of CO₂ capture and CO₂ compression on the efficiency penalty are investigated.
- Chemical absorption and other CO₂ capture technologies are introduced.

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ABSTRACT

Carbon dioxide (CO₂) capture and storage (CCS) is a promising countermeasure against global warming, but installing CCS into a power supply system causes a significant decrease in power output. Much research has already focused on the issue of how to facilitate implementation of CCS technology. This paper reviews recent studies on the efficiency penalty of coal-fired power plants with CCS. Efficiency penalty, which represents a net decrease in the power efficiency caused by the CO₂ capture and compression process, can be estimated using process simulation that considers factors such as the power generation steam cycle, coal type, and CO₂ capture and compression process. According to previous research, the efficiency penalty for current applications was about 10%. The ratio of efficiency penalty caused by CO₂ capture to the total efficiency penalty was about two thirds. It appears that while the types of power plant and coal had little influence on efficiency penalty, the CO₂ capture technology was critically important. By reducing the regeneration energy of the CO₂ scrubbing solvent by 1 GJ/t-CO₂, an approximate 2% efficiency improvement can be expected.

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Contents

1. Introduction	711
2. Efficiency penalty of a coal-fired power plant with CCS	712
2.1. Power generation	712
2.2. Analysis methods	713
3. Studies focusing on coal-fired power plants.	713
3.1. Power plant specifications	713
3.1.1. Power plant type	713
3.1.2. Coal type	714
3.2. CO ₂ capture facilities.	714
3.2.1. Location of steam extraction	714
3.2.2. Newly built or retrofit	715
3.3. Electric power supply and demand	715
3.3.1. CO ₂ capture load.	715
3.3.2. Flexible operation.	715
4. Studies focusing on CO ₂ capture technology	715
4.1. CO ₂ capture	715
4.1.1. Chemical absorption.	715

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