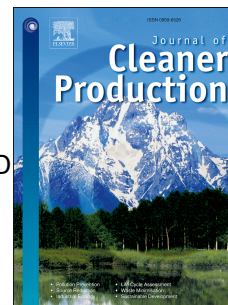


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# A novel decomposition analysis of green patent applications for the evaluation of R&D efforts to reduce CO<sub>2</sub> emissions from fossil fuel energy consumption

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## Abstract

Many green technologies have been invented to prevent CO<sub>2</sub> emission. But the alarming increased in CO<sub>2</sub> emissions in the last half-century can also induce the advancement of green technology. In order to evaluate the effect of changes in CO<sub>2</sub> emissions on green R&D investment and the generation of related patents, a new logarithmic mean Divisia index (LMDI) decomposition method is proposed. The method identifies the effect of CO<sub>2</sub> changes on patent applications via R&D investment using the following six factors: production, energy intensity, fuel mix, CO<sub>2</sub> emission coefficient, R&D reaction, and R&D efficiency. Using the data from 2004 to 2012, we apply the proposed method to the four countries (France, Germany, Italy, and the United Kingdom) in order to compare the main factors driving green patent applications in each country. The findings provide insight for effective generation of green technology patents.

**Keywords:** LMDI; energy consumption; patent; energy-related CO<sub>2</sub> emissions; R&D effort; green technology.

### Highlights:

- \* We propose new LMDI to evaluate the effect of CO<sub>2</sub> emissions on the green R&D activity.
- \* We consider R&D reaction and efficiency to be significant indicators of a new decomposition framework.
- \* R&D reaction and efficiency are the main causes of changes in green patent application.
- \* Our findings can help reduce fossil fuel energy-related CO<sub>2</sub> emissions and generate green technologies.

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