

Is European Iron and Steel Production Energy Efficient?

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Energy and Climate Studies

Energy and Climate Studies
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The division of Energy and Climate Studies (ECS) has an interdisciplinary character with a strong systems approach, linking issues related to energy technology and policy, climate change and sustainable development.



At present, ECS works with four defined research themes:

- bioenergy systems,
- energy access,
- energy systems efficiency, and
- energy and climate policy.

These are some of the central research questions at ECS.

What solutions can be pursued globally and regionally?

Which of them will lead to sustainable development?

What are the solutions that will lead to mitigation and adaptation to climate change while also promoting sustainable development?

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Insights from this research is expected to give additional value for the implementation of the Innovation Project Energy Systems Analysis Agency (ESA²), funded by KIC InnoEnergy.



ESA² provides qualified decision support for public and private clients in areas related to energy and environmental policy.

More information about ESA² is available at www.esa2.eu.



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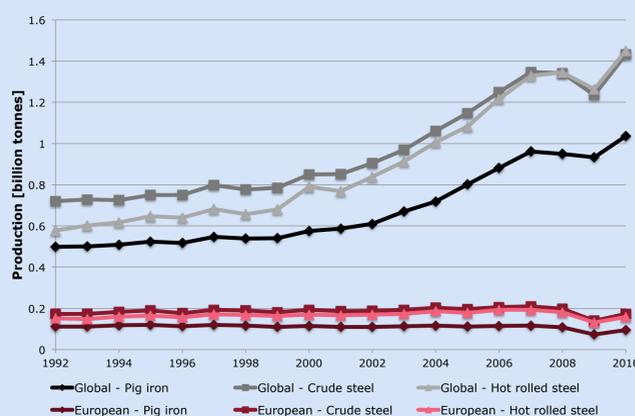
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Problem formulation

Global market competition

- Production has increased in several segments of the industry globally, while European production has remained stable [1].
- The rapid increase in capacity in the East pose a major threat to European production [2].



High-value products: to remain competitive

- European production has shifted towards high-value sets of products and full integration into product manufacturing [2].

Lack of sufficient indicators

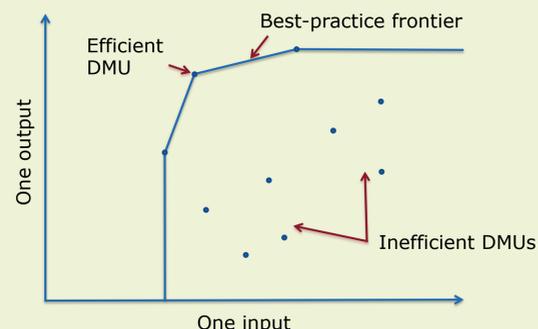
$$SEC_{steel} = \frac{\text{Energy consumption}}{\text{Crude steel production}}$$

- Specific Energy Consumption (SEC) has been criticized for being misleading for evaluating energy efficiency of iron and steel production in the European context due to the use of crude steel as the benchmark product [3].
- A more comprehensive approach to energy efficiency analysis is needed, taking the diverse sets of products into account.

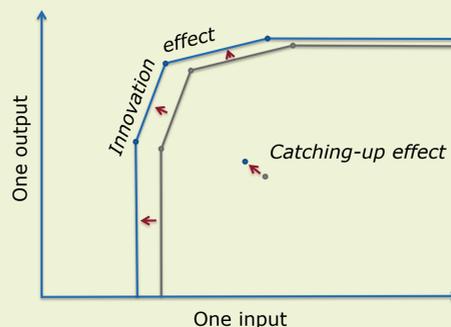
Developing new indicators

Data Envelopment Analysis

DEA is used for productivity evaluation based on how efficient a Decision Making Unit (DMU) uses inputs to produce outputs. The most efficient DMUs constructs a best-practice frontier, enveloping the inefficient DMUs (see figure*) [4].



* Using multiple inputs/outputs the frontier becomes multi-dimensional.

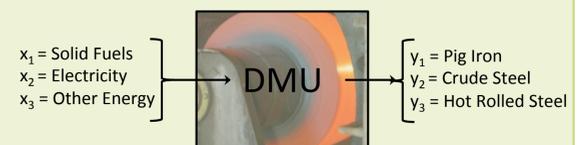


Malmquist Productivity Index

MPI is used to decompose trends over time, describing the catching-up effects and innovation effects of the DMUs. These effects indicate if the DMUs are catching up to the best-practice frontier and how the best-practice frontier is progressing between two time periods [4].

Energy Efficiency Analysis

In this analysis, the DMUs are the iron and steel production activities of each of the EU-27 Member States.



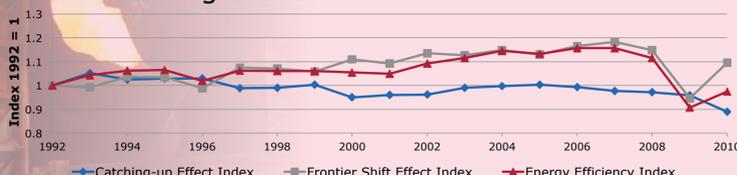
Activities included in the DMUs:

- pig iron production,
- steel production,
- casting of steel, and
- rolling of steel.

Energy use data was extracted from EUROSTAT and production data from World Steel Association.

Results

- Overall energy efficiency progress of 16 % from 1992 to 2007, but regress over the full period 1992-2010.
- Indication of high impact on energy efficiency of the economic instability in 2008-2009.
- Energy efficiency progress was mainly due to the frontier shift effect, the catching-up effect was stable or regressed.



Conclusions and next steps

- Energy efficiency increased due to advances in best-practice up until 2007.
- The increased gap between inefficient and efficient Member States indicates a potential for technology transfer.
- The current analysis showed energy efficiency regress over the period, contradicting the SEC.

Suggestions for next steps are:

- analyses of the factors influencing these trends,
- further development of indicators, including an economic perspective and the environmental impacts of production in the analysis.

REFERENCES

- [1] World Steel Association, 2012. *Steel Statistical Yearbook*. Brussels, Belgium.
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 - [4] Cooper, W.W., Seiford, L.M., Tone, K., 2007. *Data Envelopment Analysis - A Comprehensive Text with Models, Applications, References and DEA-Solver Software*. Springer
- Pictures used in this poster are courtesy of Jernkontoret, photographer was Stig-Göran Nilsson.