Coping with drawbacks of conventional CO_2 abatement curves - A case study on fossil and renewable gases

Britta Kleinertz (1), Andrej Guminski (1), Anika Regett (2), Jane Bangoj (2)
(1) Forschungsgesellschaft für Energiewirtschaft mbH
(2) Forschungsstelle für Energiewirtschaft e.V.
München, Deutschland / +49 89 158 121 0
BKleinertz@ffe.de / AGuminski@ffe.de / ARegett@ffe.de

Introduction

Achieving climate targets requires model based evaluations of transition pathways **as well as** an understandable communication of the results to important stakeholders such as politicians, industry and general public.
Presenting complex issues in a simplified manner inevitably leads to a trade-off between including all allegedly important details and assumptions and choosing a comprehensible format.
In this context, greenhouse gas (GHG) abatement cost curves have been discussed controversially. These curves are a suitable method for transferring information on GHG abatement measures to different stakeholders.
However, in their form these curves omit crucial assumptions, thereby leaving room for misinterpretation.
Here, we show a methodology and visualization approach which can alleviate three shortcomings of the original version of the curve.

Conventional CO_2 abatement cost curve:

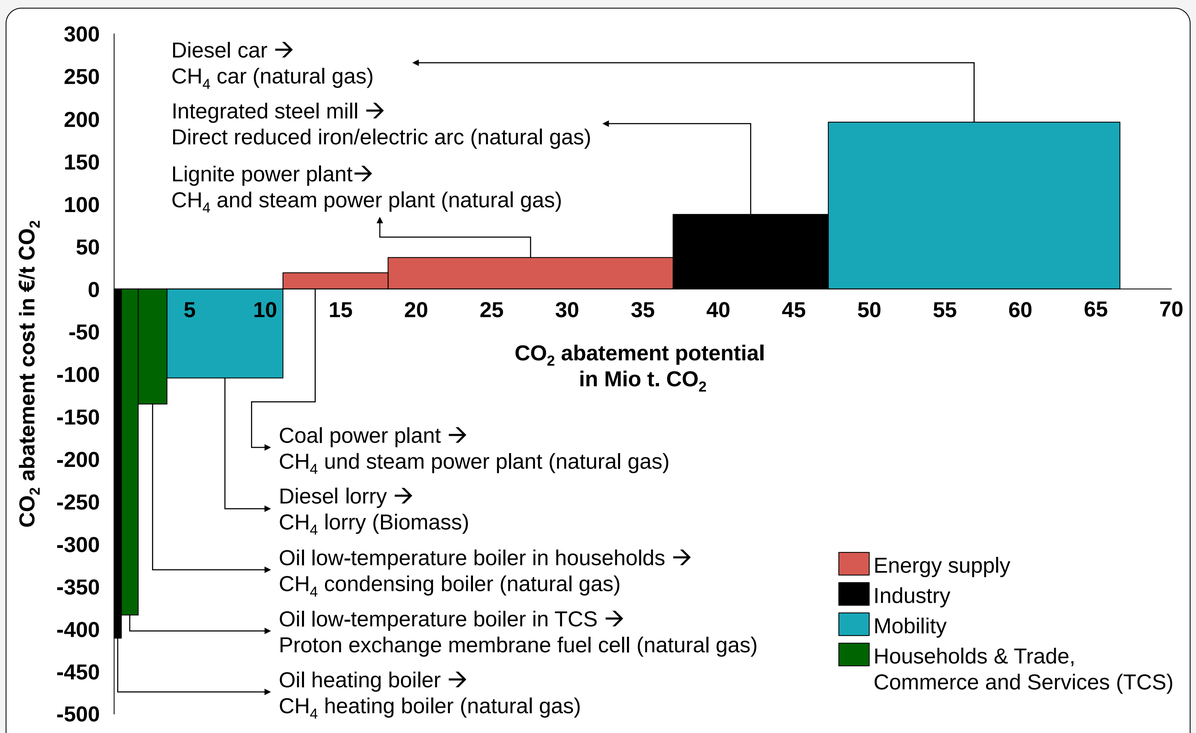

Figure presents selected results for the year 2030 from a system perspective

Advantages of conventional curve

GHG abatement cost curves have been criticized by renowned scholars and institutes. Nevertheless, GHG abatement cost curves…

… allow a concise and easy-to-read presentation of costs and potentials of several GHG abatement measures.
… can be used to display the cross-sectoral ranking of GHG abatement measures.
… indicate certain sectors or technologies, for which the implementation of GHG abatement measures should occur first.
… provide an ad-hoc indication of the effect that a CO_2-price can have on the costs of abatement measures.
… are a tool for quick and comprehensive policy advice and can build the basis for the design of climate policy instruments.

But the advantages of GHG abatement cost curves should always be viewed in the light of their **shortcomings**!

Formula for CO_2 abatement costs:

$$AC_{R,M,p,y} = \frac{\Delta C_{p,y}}{\Delta E_y} = \frac{C_{M,p,y} - C_{R,p,y}}{E_{R,y} - E_{M,y}}$$

AC = Abatement Cost
R = Reference
M = Measure
p = Perspective
y = Year
C = Costs
E = Emissions

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Disadvantage of conventional curve:

– Visualization only of final CO_2-abatement costs, neglects the importance of individual parameters included, leading to the risk of misinterpretation.

Advantages of new supplementary matrix:

+ The emission and cost difference between reference and substitute scenario, which serve as basis for CO_2 abatement costs, are displayed in order to facilitate the interpretation.

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Disadvantage of conventional curve:

– Transparency with regard to input data and assumptions (e.g. cost perspective) is lacking.

Advantages of new supplementary matrix:

+ Two cost perspectives (system vs. investor) are compared to identify discrepancies for different stakeholders.
+ The cost structure (fix and variable costs) is displayed for easier interpretation and as a first indication of sensitivities.

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Disadvantage of conventional curve:

– Interdependencies between measures, e.g. with regard to CO_2 abatement potentials and costs, are not considered.

Advantages of new supplementary matrix:

+ The potential is not displayed cumulatively but individually. This offers the possibility to display competing measures in one figure.

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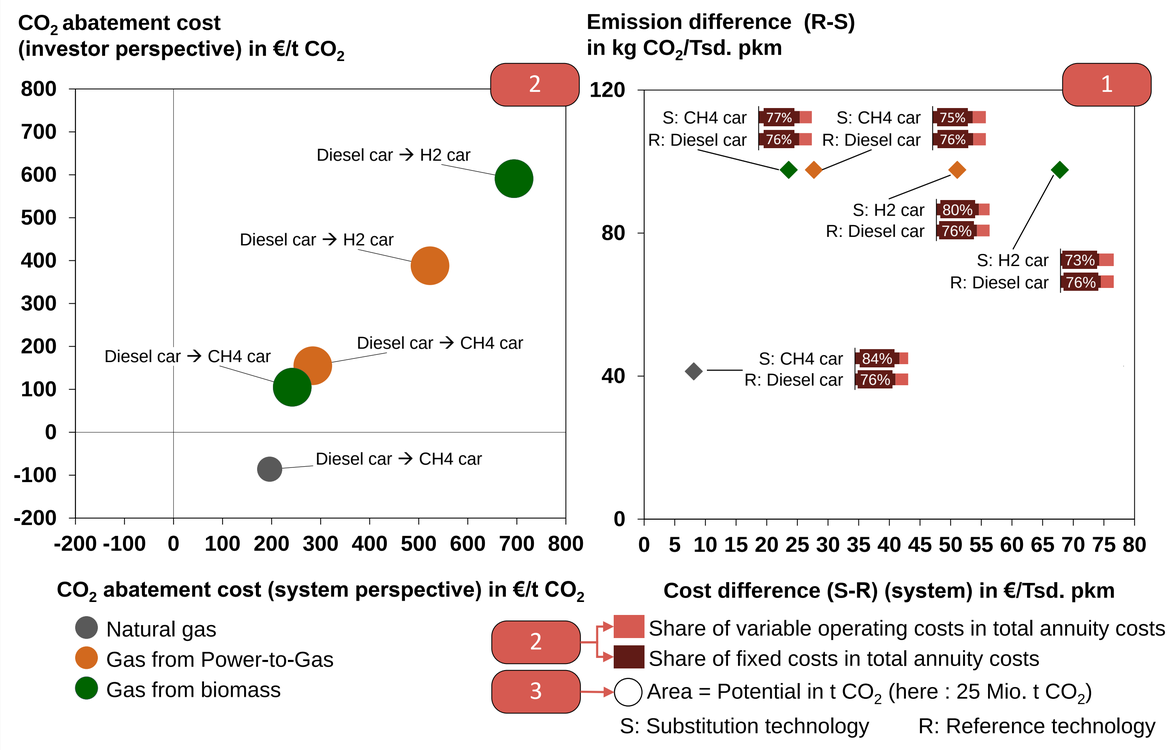
Disadvantage in both visualization methods:

– The assessment provides only results for a snapshot in time and does not consider system effects (e.g. necessity for grid expansion, limited biomass potential).

A dynamic assessment of CO_2 abatement measures, including energy system interactions, is part of the project „Dynamis“

New CO_2 abatement cost matrix:



Figures presents selected results for the year 2030

Results

Result 1 - Methodology
A methodology and visualization method, to reduced the room for misinterpretation of GHG abatement cost curves, have been developed. Moreover, these allow the derivation of sensitivities.

Result 2 – Renewable gases
A cross-sectoral analysis of the CO_2 abatement costs, for a substitution of liquid and solid fossil fuels with fossil and renewable gases, was performed.

- CO_2 abatement costs are high in high-temperature process heat supply and private transport.
- Low-temperature heat supply is characterized by low CO_2 abatement costs, and in some cases even cost savings are achieved.
- By 2030, a cross-sectoral reduction in CO_2 abatement costs occurs, mainly due to the expected falling costs for electricity based renewable gases.

Outlook on further research

The limitations of the work related to this poster present opportunities for further research and are coherent with further limitations of conventional GHG abatement cost curves.
Limitations and ideas for further research include:

- The presented cost curves show the CO_2 abatement costs. Further research could focus on including other GHG gases.
- The presented emission reduction potential focuses on the emissions during the use phase of appliances. This could be expanded to a full life cycle analysis.
- A core drawback is that system interdependencies are not included. The FfE project “Dynamis” addresses this shortcoming.

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Anmeldung: www.ffe.de/dynamis

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For further information on paper and project:
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