COMPLEMENTING WEAKNESSES IN MARGINAL ABATEMENT COST CURVES

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Overview

We develop the Y factor that is intended to give policy makers insight in *why* abatement options may or may not be hard to realize, apart from their abatement costs.

Marginal abatement cost curves (MACC) are a prominent tool for what the potential is for reducing CO_2 (and other greenhouse gas) emissions on the horizontal axis and the costs to do so, in terms of costs per ton CO_2-equivalent reduced, on the vertical axis (Nauclér and Enkvist 2009). The strength of the MACC is its elegance: it is an overview of the options to reduce emissions sorted on cost. It indicates what the reduction potential is given an expected or desired price level. A complicated model is behind the analysis that produces these curves and this includes a number of sector interactions. McKinsey provides a variety of other indicators that aid interpretation. The core of the analysis, however, is not represented in the famous curve, but is in the set of assumptions. Though elegant, this makes a MACC hard to use for what we can expect and what abatement options we should support. Many of the difficulties of interpreting the MACC relate to factors that make decisions 'irrational' in the sense that the abatement option may not be realized at the CO_2 price level estimated by the MACC. All the options with a negative abatement cost illustrate this: they should have been realized if nothing was hampering implementation.

So far, no elegant and useful curve underlines this fact and that has serious consequences: policy makers are still inclined to assume that the 'cheapest' options are the ones that will happen first, and will see that many of the affordable options do not materialize. Ekins et al (2011) analysed that policy makers should embrace complexity, pay attention to the assummptions behind the curve as well as the curve itself, look beyond the estimated technology cost, accept uncertainty and understand path dependencies. We argue that other elegant analyses are needed alongside the MACC. In this abstract, we focus on the vertical axis – the y-axis – and we coin the *Y-factor* that shows why it is difficult for abatement options to materialize. Preliminary results are presented in this abstract.

Methods

The Y-factor method is based on well-kwown barriers that we derived from a variety of sources and sectors and structured according to their nature. The Y-factor is determined by scoring an abatement option per factor (0, 1 or 2) and summing them. We identified 13 factors in four categories, leading to a score between 0 and 26. The result is *why* (Y) an abatement option is difficult to achieve, apart from the fact that it is costly in terms of abatement cost that is the basis for the MACC. The factors are listed in Table 1.

Table 1. List of factors and score definitions.

Category	**Factor**	**Value 0**	**Value 1**	**Value 2**
Costs and financing	Investment cost required	Absent	Medium	Large
	Expected pay-back time at €0 euro/ton	< 5 years	5-12 years	> 20 years
	Difficulty in financing investment	None	Medium	Large
Multi-actor complexity	Dependence on other actors	None	Few	Many
	Number of actors	Few	Many	Millions
	Types of actors involved incl. conflicts	Low/none	Medium/medium	Many/large
	Responsibility unclear	No	Slightly	Unclear
Physical interdependences	Physical embeddedness	No	Medium	Strongly
	Disturbs regular operation	No	Slightly	Strongly
	Technology uncertainty	Fully proven	Small	Large
Behavior	Outside of thinking scope of actor	No	Partly related	Outside
	Frequency of opportunity	Often	Medium	Rarely
	Requires change in behaviour	No	Slight	Severe

Results

Based on McKinsey data and first discussions we scored the top 50 abatement options from McKinsey's most recent curve (Nauclér and Enkvist 2009). Some of the factors varies widely over different regions. In the scores in Figure 1, we chose Europe or the Netherlands if we were forced to be more specific. The results suggest that the order the factors hampering abatement do matter. The minimum value is 5 and the maximum is 19.

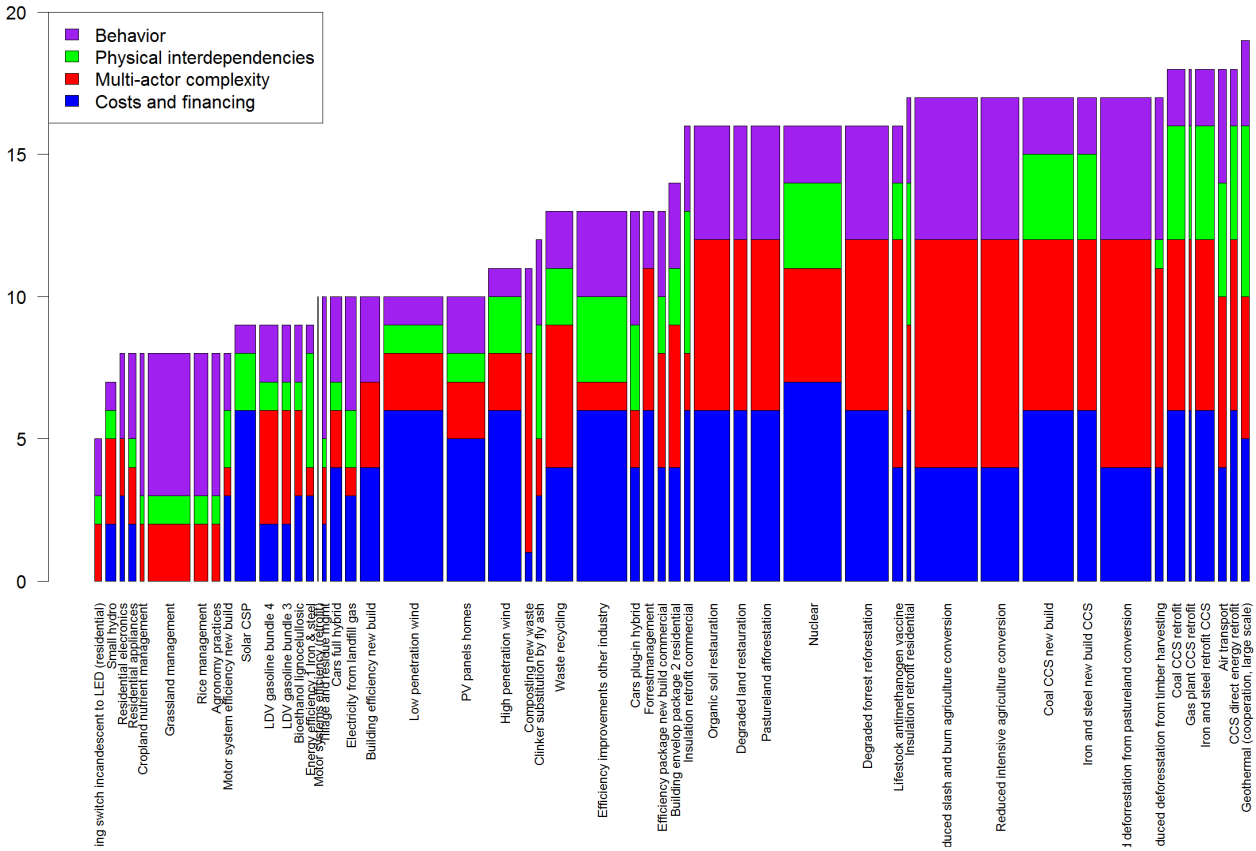

Figure 1. First results of the Y-factor of the top 50 abatement options. Vertical axis: Y-factor. Horizontal axis: McKinsey's global abatement potential compared to business as usual (total ~30 $GtCO_2$-eq).

Conclusions

We develop a complementary curve for the famous marginal abatement cost curve called the Y-factor, which is a score based on hampering factors with respect to costs and financing, multi-actor complexity, physical interdependencies, and behavior. First results confirm that the hampering factors for abatement matter. Most options score relatively high, which implies that – besides the cost – emission reductions are harder to achieve than is generally acknowledged. The usefulness of this curve is illustrated by the fact that the order of the options is quite different in comparison to the original MACC that ordered to abatement costs.

References

Ekins, P.; Kesicki, F. & Smith, A. Z. P. (2011), 'Marginal Abatement Cost Curves: A call for caution', Technical report, UCL Energy Institute, University College London.

Nauclér, T. & Enkvist, P.-A. (2009), 'Pathways to a Low-Carbon Economy - Version 2 of the Global Greenhouse Gas Abatement Cost Curves', Technical report, McKinsey.

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