Appendix B: Comparison of U.S. Marginal Abatement Cost Curves from a McKinsey & Co. Study with Results from the MIT EPPA Model*

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This note provides a short comparison of Marginal Abatement Cost (MAC) curve derived for USA for 2030 in the McKinsey and Company report (Creyts *et al.*, 2007) with a curve obtained from the MIT Emissions Prediction and Policy Analysis (EPPA) model (Paltsev *et al.*, 2005). The MIT Joint Program's approach to constructing MACs, which is a relationship between tons of emissions abated and the CO_2 (or GHG) price, is described in a recent report by Morris *et al.* (2008).

Figure B1 shows the McKinsey and Co (in grey) and MIT EPPA curves (in red) for all greenhouse gases (GHGs) for 2030. The first thing to note is that the EPPA MAC does not have any negative costs, while McKinsey analysis states that "almost 40 percent of abatement could be achieved at "negative" marginal costs". The McKinsey curve is bounded by construction at \$50/tCO_2e cost and the resulting 3Gt CO_2e reduction in emissions.

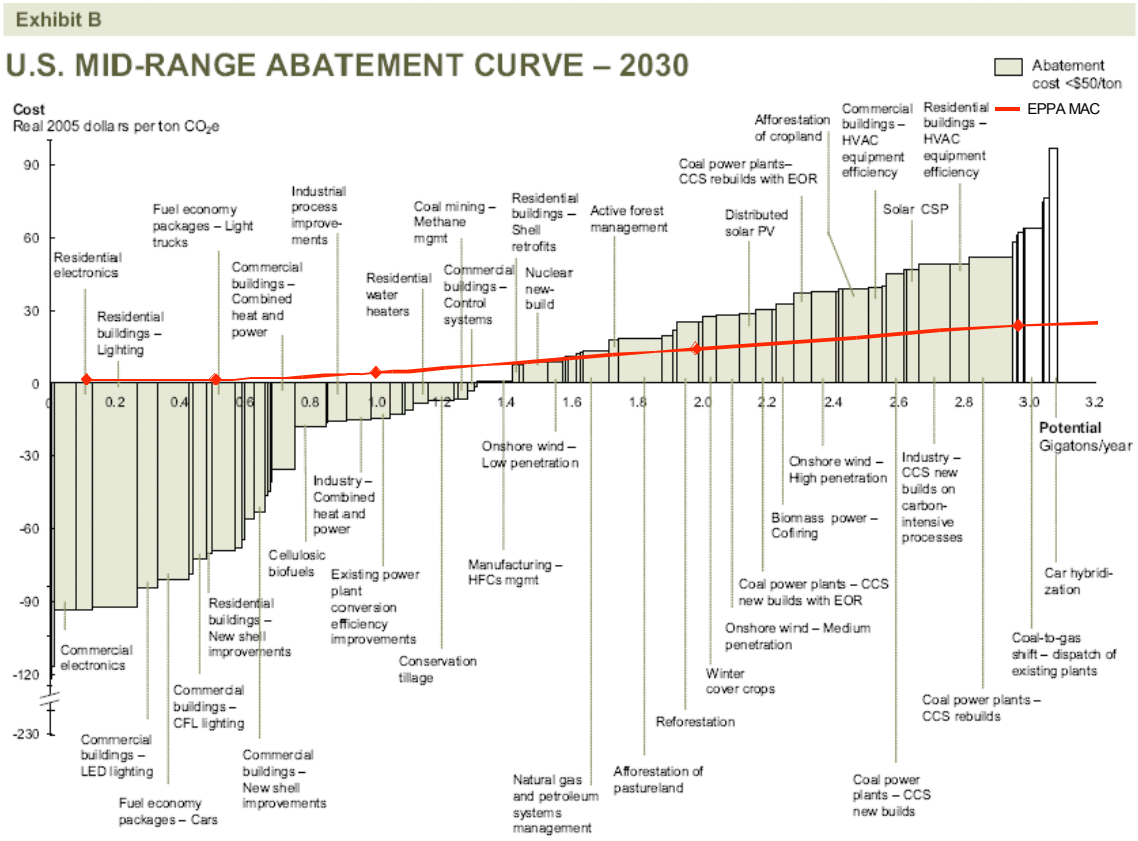

Figure B1. McKinsey and EPPA Abatement Cost Curves for USA in 2030 (all GHGs).

* This is an appendix to Morris *et al.* (2008) Marginal Abatement Costs and Marginal Welfare Costs for Greenhouse Gas Emissions Reductions: Results from the EPPA model, MIT Joint Program on the Science and Policy of Global Change, Report 164 (http://globalchange.mit.edu/files/document/MITJPSPGC_Rpt164.pdf).

To put this level of reduction in perspective, one can consider the following data. In 2005 the U.S emitted 7.05 $GtCO_2e$. In the last 15 years, from 1990 to 2005, the U.S. GHG emissions have increased by 15%, which corresponds to a 1% annual growth. Assuming that in the next 25 years, from 2005 to 2030, the emissions would increase only at half of the previous growth rate, the 2030 U.S. emissions would be around 8 $GtCO_2e$ in the reference case of no climate policy. Abatement of 3 Gt from the projected 2030 level would correspond to about a 20% reduction from 1990 GHG emission levels.

Integrating the area under a MAC curve can provide a rough estimate of the total cost (for uses and abuses of MACs and their relationship to welfare costs, see Morris *et al.*, 2008). A crude approximation of the area under the McKinsey curve combines a negative cost of $54 billion in the first part of the curve and a positive cost of $37.5 billion in the second part of the curve (approximated by the areas of triangles: ½*90*1.2 and ½*50*1.5), so the total cost is around negative $16.5 billion. The same exercise for the MIT EPPA curve results in the cost of $33 billion. So the difference between the total costs is around $50 billion, which is mostly driven by the negative part of McKinsey curve (for an example of how bottom-up based engineering studies can be misleading as a guide to an economy-wide policy, see Jacoby, 1998).

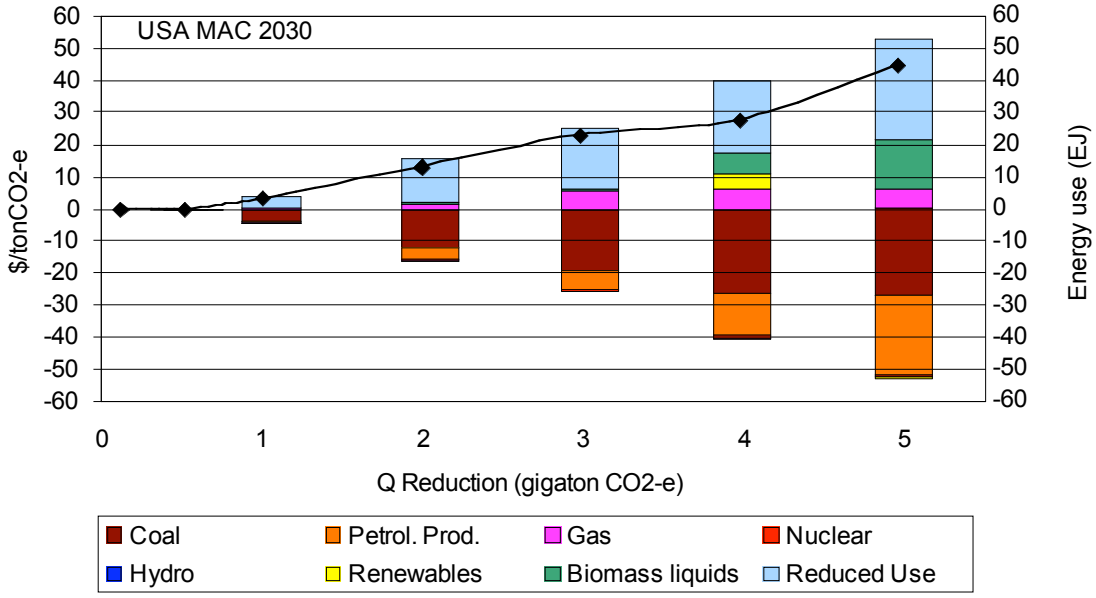

Figure B2. MAC from EPPA for USA in 2030 (left scale) and change in energy use (right scale)

Figure B2 separates out components of change in the U.S. energy system in 2030, at each of the MAC points, as derived from the MIT EPPA model. We focus here on the changes in energy use by fuel type and overall reductions in energy use. We cannot easily assign distinct technologies and practices in the MAC as in the McKinsey analysis because in our modeling approach there is a continuum of responses as the CO_2e price rises. For example, at low prices some reduction in energy use occurs and as the price rises there is more substitution away from

energy. Similarly, some uses of coal are reduced at low costs and more reduction occurs at higher costs. Also there is interaction among different technologies and policies that cannot be easily decomposed in the MAC derived from the EPPA model. The solid black line represents an extended MAC (not truncated at 3Gt CO_2e of abatement), while the bars and the right scale shows the changes in energy use at different levels of abatement. The biggest reduction comes from a decrease in coal and petroleum products use, and a reduction in energy use due to a demand response. At the same time, there is an increase in biofuels, gas, and renewables. Considering political constraints, we keep nuclear energy roughly constant in this exercise.

REFERENCES

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