Nitric and Adipic Acid Production

Global abatement potential in 2020 and 2030 is 106 and 120 $MtCO_2e$, respectively. Over 61% of the abatement potential is concentrated in the top 5 emitting countries that include Brazil, Canada, China, South Korea, and the United States. The results of the MAC analysis are presented in Table 1 and Figure 1 below by major country and regional grouping at select break-even prices in 2030. In addition, Figures 2 and 3 present the United States and Global MAC curves in 2010, 2020 and 2030.

This analysis considered five abatement measures applied to the chemical processes used to produce nitric and adipic acid to reduce the quantity of nitrous oxide (N_2O) emissions released during the production process. Thermal destruction is the abatement measure applied to the adipic acid production process. The four remaining measures were applied to the nitric acid production process. Abatement measures applicable to nitric acid are characterized by where in the production process they are implemented. These options include secondary catalysts, tertiary catalysts, and non-selective catalytic reduction (NSCR) units. Secondary catalysts are installed at an intermediate point in the production process preventing the formation of N_2O in later stages of production process. Tertiary catalysts and NSCR units are applied to the tail gas streams at the end of production process. The implementation of one technology over another is driven largely by facility design constraints. The capital intensity of NSCR units and improvement in modern facility design will drive most future abatement projects to adopt secondary or tertiary catalysts over NSCR units.

The majority of abatement in N_2O from nitric and adipic acid production could be achieved at breakeven prices between \$5 and \$30/tCO_2e. These N_2O abatement measures do not provide cost savings or revenue. Therefore, there are no cost-effective reductions achievable without additional incentives for emissions reductions (e.g. tax incentive, subsidy, or carbon price).

Table 1: Abatement Potential by Region at Selected Break-Even Prices (\$/tCO_2e) in 2030

Country/Region	Break-Even Price										
	−10	−5	0	5	10	15	20	30	50	100	100+
Top 5 Emitting Countries											
Brazil	-	-	-	2.2	7.1	7.8	7.8	9.9	9.9	9.9	9.9
Canada	-	-	-	0.7	1.5	3.0	3.0	4.0	4.5	4.5	4.5
China	-	-	-	3.6	5.6	7.4	7.4	7.4	8.4	8.4	8.4
South Korea	-	-	-	6.6	13.8	15.2	15.2	19.4	19.4	19.4	19.4
United States	-	-	-	4.8	10.6	20.7	20.7	24.2	27.5	31.2	31.2
Rest of Region											
Africa	-	-	-	1.7	2.4	3.2	3.2	3.2	3.2	3.2	3.2
Central & South America	-	-	-	0.3	0.7	0.8	0.9	1.1	1.1	1.1	1.1
Middle East	-	-	-	0.3	0.8	1.0	1.0	1.3	1.3	1.3	1.3
Europe	-	-	-	5.1	14.4	19.9	22.7	25.1	28.2	28.2	29.3
Eurasia	-	-	-	2.4	4.1	5.2	5.3	5.5	5.5	5.5	5.5
Asia	-	-	-	1.7	4.0	5.0	5.6	6.2	6.5	6.6	6.7
North America	-	-	-	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**-**	**-**	**-**	**29.5**	**65.2**	**89.2**	**92.8**	**107.3**	**115.4**	**119.3**	**120.5**

Figure 1: Marginal Abatement Cost Curve for Top 5 Emitters in 2030

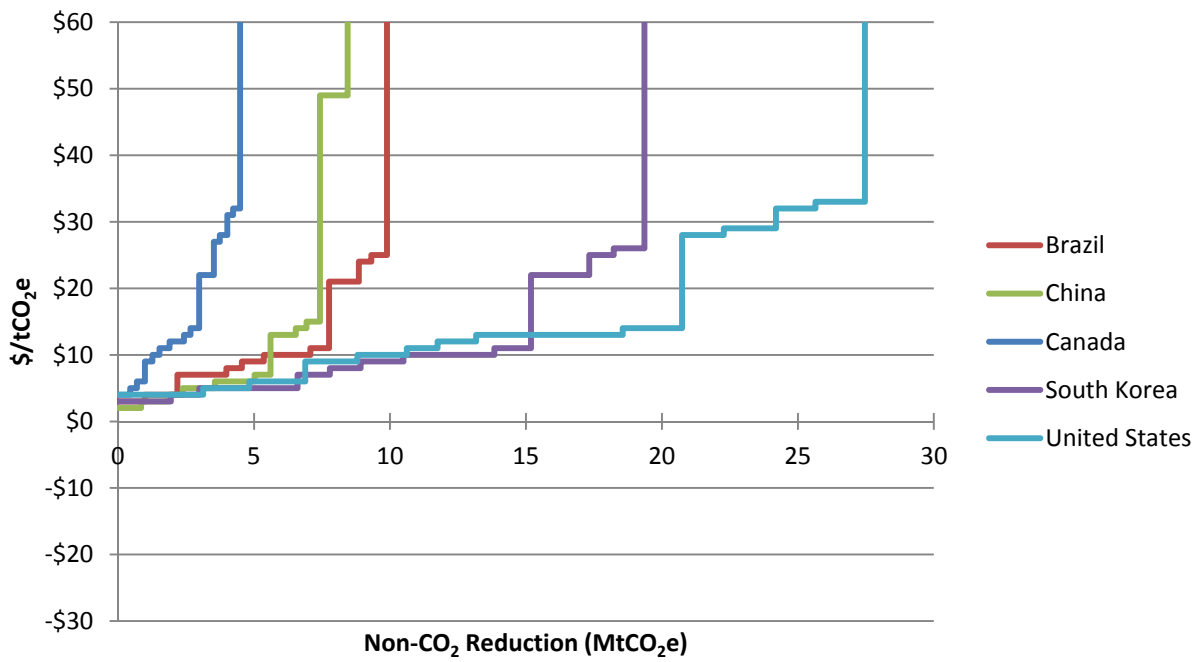

Figure 2: United States Marginal Abatement Cost Curve in 2010, 2020, and 2030

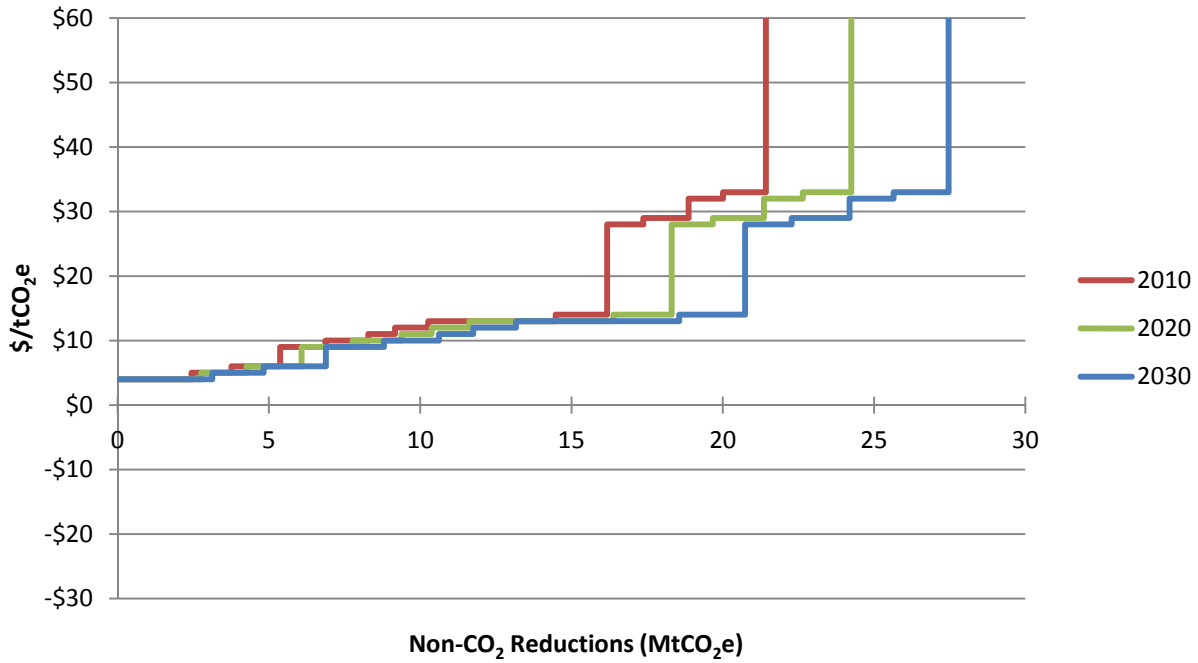
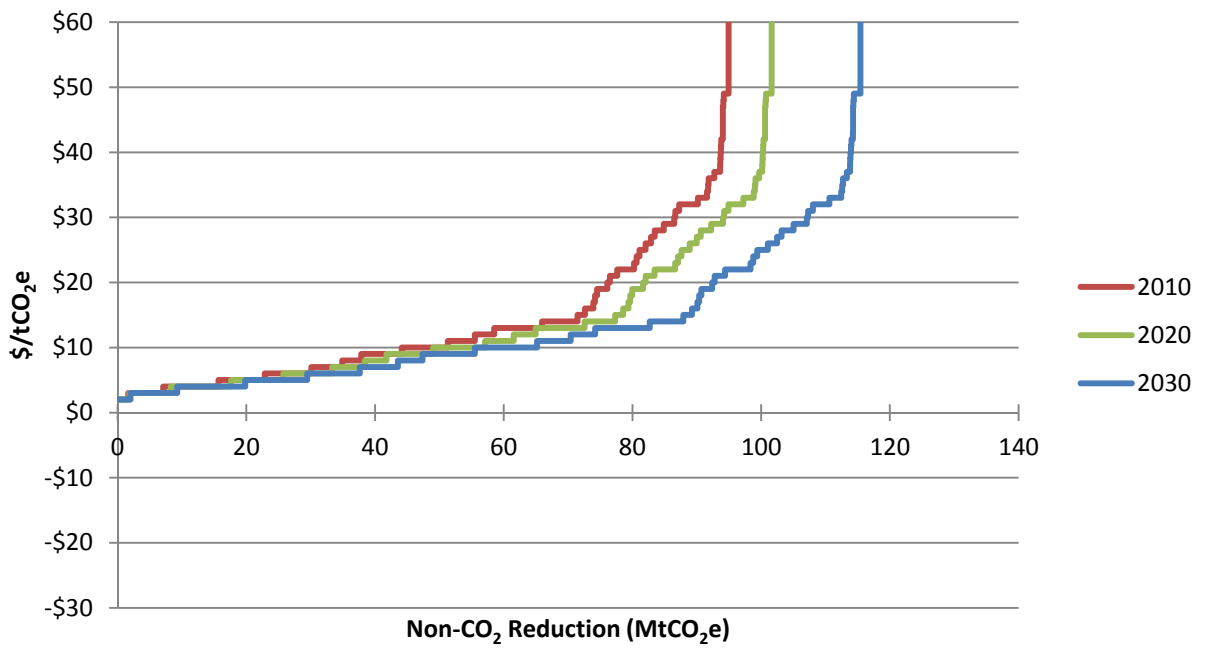
Figure 3: Global Marginal Abatement Cost Curve in 2010, 2020 and 2030