Analysis of US and State-by-State Carbon Dioxide Emissions and Potential "Savings" in Future Global Temperature and Global Sea Level Rise

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ANALYSIS OF US AND STATE-BY-STATE CARBON DIOXIDE EMISSIONS (FOR 2010) AND POTENTIAL "SAVINGS" IN FUTURE GLOBAL TEMPERATURE AND GLOBAL SEA LEVEL RISE FROM A COMPLETE CESSATION OF ALL CO_2 EMISSIONS

by Paul Knappenberger | April 8, 2013

- Using assumptions based on the Intergovernmental Panel on Climate Change (IPCC) Assessment Reports*, if the U.S. as a whole stopped emitting all carbon dioxide (CO_2) emissions immediately, the ultimate impact on projected global temperature rise would be a reduction, or a "savings," of approximately 0.08°C by the year 2050 and 0.17°C by the year 2100—amounts that are, for all intents and purposes, negligible.

- The impact of a complete and immediate cessation of all CO_2 emissions from the U.S. on projections of future sea level rise would be similarly small—a reduction of the projected sea level rise of only 0.6cm by 2050 and 1.8cm (less than one inch) by the year 2100.

- The current growth rate in CO_2 emissions from other countries of the world will quickly subsume any reductions in U.S. CO_2 emissions. According to data from the U.S. Energy Information Administration (EIA) and based on trends in CO_2 emissions growth over the past decade, global growth will completely replace an elimination of all CO_2 emissions from the U.S. in just 7 years, while growth in emissions from China alone will subsume an elimination of all U.S. emissions in just under 11 years.

- As the CO_2 emissions from individual states are considerably less than the U.S. total, so too are the potential "savings" of global warming and sea level rise that any individual state can expect through reducing or even completely eliminating all CO_2 emissions originating from within its borders.

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Analysis of Carbon Dioxide Emissions (for 2010) and Potential "Savings" in Future Global Temperature and Global Sea Level Rise from a Complete Cessation of All CO_2 Emissions

State	2010 Emissions (million metric tons CO_2)	Percentage of Global Total	Time until Total Emissions Cessation Subsumed by Foreign Growth (days)		Temperature "Savings" (°C)		Sea Level "Savings" (cm)	
			Global Growth	China Growth	2050	2100	2050	2100
AL	132.7	0.42	60	93	0.0020	0.0041	0.0141	0.0424
AK	38.7	0.12	18	27	0.0006	0.0012	0.0041	0.0124
AZ	95.9	0.30	44	67	0.0014	0.0029	0.0102	0.0307
AR	66.1	0.21	30	46	0.0010	0.0020	0.0070	0.0211
CA	369.8	1.17	168	260	0.0055	0.0113	0.0394	0.1182
CO	96.5	0.31	44	68	0.0014	0.0029	0.0103	0.0308
CT	36.9	0.12	17	26	0.0005	0.0011	0.0039	0.0118
DE	11.7	0.04	5	8	0.0002	0.0004	0.0012	0.0037
DC	3.3	0.01	1	2	0.0000	0.0001	0.0003	0.0010
FL	246.0	0.78	112	173	0.0036	0.0075	0.0262	0.0786
GA	173.7	0.55	79	122	0.0026	0.0053	0.0185	0.0555
HA	18.9	0.06	9	13	0.0003	0.0006	0.0020	0.0060
ID	16.2	0.05	7	11	0.0002	0.0005	0.0017	0.0052
IL	230.4	0.73	105	162	0.0034	0.0070	0.0245	0.0736
IN	219.1	0.70	100	154	0.0032	0.0067	0.0233	0.0700
IA	88.7	0.28	40	62	0.0013	0.0027	0.0095	0.0284
KS	75.0	0.24	34	53	0.0011	0.0023	0.0080	0.0240
KY	150.7	0.48	69	106	0.0022	0.0046	0.0161	0.0482
LA	223.5	0.71	102	157	0.0033	0.0068	0.0238	0.0714
ME	18.5	0.06	8	13	0.0003	0.0006	0.0020	0.0059
MD	70.5	0.22	32	50	0.0010	0.0022	0.0075	0.0225
MA	73.0	0.23	33	51	0.0011	0.0022	0.0078	0.0233
MI	165.9	0.53	75	116	0.0024	0.0051	0.0177	0.0530
MN	93.4	0.30	43	66	0.0014	0.0029	0.0100	0.0299
MS	65.5	0.21	30	46	0.0010	0.0020	0.0070	0.0209
MO	135.7	0.43	62	95	0.0020	0.0041	0.0145	0.0434
MT	34.9	0.11	16	25	0.0005	0.0011	0.0037	0.0112
NE	48.0	0.15	22	34	0.0007	0.0015	0.0051	0.0153
NV	38.1	0.12	17	27	0.0006	0.0012	0.0041	0.0122
NH	17.0	0.05	8	12	0.0003	0.0005	0.0018	0.0054
NJ	115.4	0.37	53	81	0.0017	0.0035	0.0123	0.0369
NM	54.8	0.17	25	38	0.0008	0.0017	0.0058	0.0175
NY	172.8	0.55	79	121	0.0025	0.0053	0.0184	0.0552
NC	142.9	0.45	65	100	0.0021	0.0044	0.0152	0.0457
ND	52.5	0.17	24	37	0.0008	0.0016	0.0056	0.0168
OH	249.1	0.79	113	175	0.0037	0.0076	0.0265	0.0796
OK	103.4	0.33	47	73	0.0015	0.0032	0.0110	0.0331
OR	40.3	0.13	18	28	0.0006	0.0012	0.0043	0.0129
PA	256.6	0.81	117	180	0.0038	0.0078	0.0273	0.0820
RI	11.0	0.03	5	8	0.0002	0.0003	0.0012	0.0035
SC	84.0	0.27	38	59	0.0012	0.0026	0.0090	0.0269
SD	15.1	0.05	7	11	0.0002	0.0005	0.0016	0.0048
TN	107.1	0.34	49	75	0.0016	0.0033	0.0114	0.0342
TX	652.6	2.07	297	458	0.0096	0.0199	0.0695	0.2086
UT	64.2	0.20	29	45	0.0009	0.0020	0.0068	0.0205
VT	6.0	0.02	3	4	0.0001	0.0002	0.0006	0.0019
VA	109.8	0.35	50	77	0.0016	0.0034	0.0117	0.0351
WA	76.1	0.24	35	53	0.0011	0.0023	0.0081	0.0243
WV	98.9	0.31	45	69	0.0015	0.0030	0.0105	0.0316
WI	99.2	0.31	45	70	0.0015	0.0030	0.0106	0.0317
WY	64.9	0.21	30	46	0.0010	0.0020	0.0069	0.0207
USA	**5,631.3**	**17.88%**	**2,563 (7.0 yrs)**	**3,954 (10.8 yrs)**	**0.0830**	**0.1720**	**0.6000**	**1.8000**

* The climate change calculations are performed using the MAGICC climate model simulator (MAGICC: Model for the Assessment of Greenhouse-gas Induced Climate Change). MAGICC was developed by scientists at the National Center for Atmospheric Research under funding by the U.S. Environmental Protection Agency and other organizations. MAGICC is itself a collection of simple gas-cycle, climate, and ice-melt models that is designed to emulate the output of complex climate models. MAGICC produces projections of the global average temperature and sea level change under user configurable emissions scenarios and model parameters. There are many parameters that can be altered when running MAGICC, including the climate sensitivity (how much warming the model produces from a doubling of CO_2 concentration) and the size of the effect produced by aerosols. In all cases, the MAGICC default settings were used (for example, a climate sensitivity of 3.0°C), which represent the middle-of-the-road estimates for these parameter values.

Assumptions about the U.S. emissions pathways were made as prescribed by the original IPCC scenarios in order to obtain the baseline U.S. emissions to which the emissions reduction schedule could be applied.

Also, assumptions about the U.S. emissions pathways were made as prescribed by the original IPCC scenarios in order to obtain the baseline U.S. emissions to which the emissions reduction schedule could be applied—taking U.S. emissions to zero (starting from 2010 levels) by the year 2020 and keeping them there to 2100 (the end of the simulation). The IPCC emissions scenarios describe the future emissions, not from individual countries, but from country groupings. Therefore, the U.S. emissions were backed out from the country groupings. To do so, the country group which the U.S. belonged to was identified (the OECD90 group) and then the current percentage of the total group emissions that are being contributed by the United States was determined—which turned out to by ~50%. The assumption was made that this percentage was constant over time. In other words, that the U.S. contributed 50% of the OECD90 emissions in 2000 as well as in every year between 2000 and 2100. In this way, the future emissions pathway of the U.S. was developed from the group pathway defined by the IPCC for each scenario (in this case, the A1B scenario). U.S. carbon dioxide emissions were zeroed out by the year 2020 (but left all other emissions as defined by the A1B scenario) and then the new U.S. emissions were recombined into the OECD90 pathway and into the global emissions total over time. It is the total global emissions that are entered into MAGICC in order to produce global temperature projections. The results using the zero-out U.S. emissions pathway were then compared to the results using the original A1B pathways as prescribed by the IPCC.

Once the projected climate (global average temperature and sea level) mitigation impacts of the zeroed out U.S. emissions (compared with the original scenario) were calculated, the "savings" for each of the 50 United States was assigned in proportion to the percentage of total U.S. carbon dioxide emitted within the borders of each state (based on 2010 emissions

numbers published by the Energy Information Administration), with the assumption that these state-by-state proportions remained constant across the remainder of the 21st century.

Additional details of the methodology and an example of how it was applied to analyze the climate impacts of the Waxman-Markey cap and trade legislation can be found here:

http://www.masterresource.org/2009/05/part-i-a-climate-analysis-of-the-waxman-markey-climate-bill%E2%80%94the-impacts-of-us-actions-alone/.

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