Marshall Policy Outlook
GEORGE C. MARSHALL INSTITUTE
July 2009

The Myth of Vanishing CO_2 Emissions, Part 2: Or, How the G-8 Demands the Implausible

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In July 2009, the leaders of the G-8, the largest world economies, gathered in Italy to discuss matters of global importance. As they are wont to do, they issued proclamations on a host of matters ranging from Iranian nuclear proliferation to economic stimulus approaches. Most interestingly, the group's July 8th declaration, *Responsible Leadership for a Sustainable Future*,[1] demands worldwide reductions in carbon dioxide (CO_2) and other greenhouse gases emissions of 50% by 2050 and commits the developed world to an 80% reduction in their emissions. Such calls for dramatic action are hardly new. In June of last year, Bill O'Keefe and I examined similar goals set out for the U.S. by the presidential candidates and legislation under consideration in the Senate (see *The Myth of Vanishing CO_2 Emissions*[2]).

In that piece, we summarized the actions required to meet emission reductions of this magnitude. We concluded then, and do again now, "The reality is that the technologies needed for reductions on the scale demanded do not exist. When and if they do come into existence, it will take decades to put them in place because the nation's capital stock turns over slowly." Strike "nation's" and replace it with "world's" and the same conclusion applies for the G-8 declaration.

The simple facts suggest that achieving emission reductions at the level of multiple gigatons will require enormous expenditures on capital infrastructure (i.e., new energy supply systems), replacement of capital stock (i.e., automobiles, heating/cooling systems), and development of carbon sequestration systems. So, in light of the U.S. House of Representatives' recent actions, the start of debate in the U.S. Senate, and the G-8 declaration, it is timely to ask again, "Is the goal of an 80% reduction in emissions achievable? At what cost?"

A Baseline: How Much Do We Emit Today?

In 2006, the most recent year for which global data is available, 29 billion metric tons of carbon dioxide were emitted globally. CO_2 is not the only greenhouse gas produced by human activities, but it is the vast majority of those emissions. The proposed 80% reduction could be achieved through mitigation efforts for other gases, but for illustrative purposes, I'll focus on CO_2 exclusively here.

As the world's largest economy, the United States predictably emitted the most carbon dioxide, 5.9 gigatons that year. China, Russia, Japan, and India remain the world's other large emitters of CO_2. The table below ranks the top fifteen global economies and shows their relative levels of CO_2 emissions and carbon intensities. U.S. GDP is more than three times that of #2 Japan, and as energy is a critical component of economic activity (moving people, goods and services or powering factories and offices), it comes as no surprise that the U.S. ranks high on the list of emitters. U.S. carbon intensity, that is the amount of CO_2 emitted per a unit of value (in this table, metric tons of CO_2 per thousand U.S. dollars), is comparable with other advanced economies.

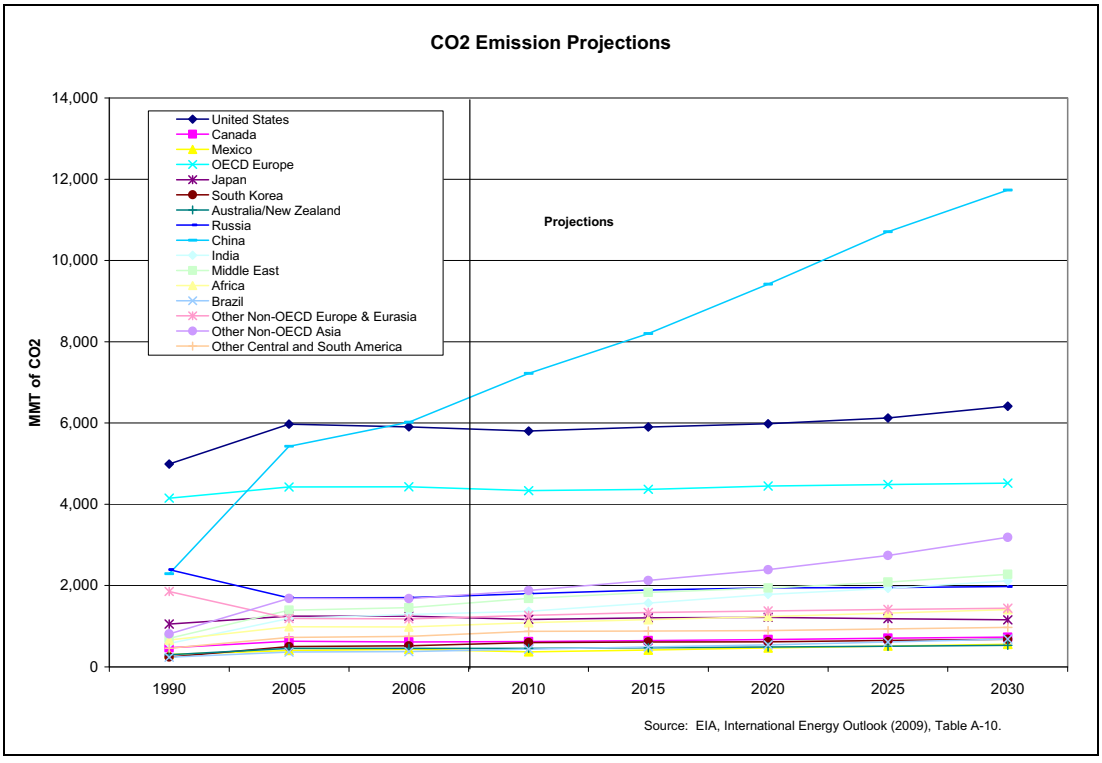
Carbon Emissions & GDP for Top-15 World Economies

Rank	Country	2008 GDP *(millions of USD)*	2006 Carbon Intensity *(Metric Ton of CO_2 per thousand USD)*	2006 CO_2 Emissions *(Million Metric Tons)*
1	United States	14,265	0.52	5,902.75
2	Japan	4,924	0.24	1,246.76
3	China	4,402	2.85	6,017.69
4	Germany	3,668	0.43	857.60
5	France	2,866	0.28	417.75
6	United Kingdom	2,674	0.35	585.71
7	Italy	2,314	0.40	468.19
8	Russia	1,677	4.54	1,704.36
9	Spain	1,612	0.53	372.62
10	Brazil	1,573	0.49	377.24
11	Canada	1,511	0.73	614.33
12	India	1,210	1.80	1,293.17
13	Mexico	1,088	0.60	435.60
14	Australia	1,011	0.89	417.06
15	South Korea	947	0.77	514.53

GDP from International Monetary Fund, World Economic Outlook Database, April 2009: Nominal GDP list of countries. Data for the year 2008.

GHG data from EIA Total Energy-Related Carbon Emissions (CO2 in Million Metric Tons) and Energy-Related Carbon Intensity (Metric Tons of Carbon Dioxide per Thousand 2000 U.S. Dollars) Tables (http://www.eia.doe.gov/environment.html)

Global CO_2 emissions are projected to rise to 40 gigatons by 2030 according to a recent projection from the U.S. Energy Information Administration released in the spring of 2009. U.S. emissions rise to 6.4 gigatons under these projections. Chinese emissions jump to 11.7 gigatons in 2030 and China becomes the world's largest emitter of CO_2.



These forecasts are sensitive to assumptions about economic growth rates and energy prices. In the May 2009 forecast, the EIA substantially revised these numbers downward from the prior year's estimates. The prior year forecast (the May 2008 edition of the *International Energy Outlook*) projected the world would emit 42.3 gigatons, including 6.8 gigatons from the U.S. and 12 gigatons from China.

How Much is an 80% Reduction?

Setting aside the scientific, technological, and economic bases for the assertion to reduce emissions by 80%, such a reduction as demanded by the G-8 presents an enormous task. The G-8 states that it is "a goal of developed countries reducing emissions of greenhouse gases in aggregate by 80% or more by 2050 compared to 1990 or more recent years."

While it is not clear whom the declaration defines as "developed" countries, one can safely assume the OECD states fall into that category. The table below shows the reductions required from OECD economies under the G-8 framework. The G-8 suggests 1990 ought to be the baseline year, which also would be consistent with the Kyoto Protocol framework, but leaves open the possibility that another year could be chosen, as is the case in recent U.S. legislation. The table offers data for an 80% reduction from a 1990 baseline and from a 2006 baseline to provide comparison.

The demanded reductions are enormous. In 1990, for example, the United States emitted 4.9 gigatons of CO_2. An 80% reduction from that level is 3.9 gigatons. Using 2006 as the baseline increases the required cut to 4.7 gigatons.

Reliable estimates of GHG emissions in 2050 do not exist. The EIA and IEA both end their projections at 2030. Extrapolating the EIA's growth trend to 2050 produces an estimated emissions level for the U.S. of roughly 6.8 gigatons in 2050. Subtracting the required reductions from that level leaves allowable emissions of 2.9 gigatons (using the 1990 baseline) or 2.1 gigatons (using the 2006 baseline). The last time the U.S. had emission levels of that size was the earliest years of the 20th century.[3]

Meeting Unrealistic Goals with Unrealistic Policies

Setting aside whether these targets have a sound basis (meaning they will achieve the desired environmental result) and without

80% Reduction in Carbon Dioxide Emissions by 2050 Under Two Baseline Years

(MMT)

	Actual Emissions		80% Reduction by 2050 *Baseline Year*	
	1990	2006	1990	2006
OECD				
OECD North America	**5,762**	**6,948**	**4,610**	**5,558**
United States	4,989	5,907	3,991	4,726
Canada	471	611	377	489
Mexico	302	431	242	345
OECD Europe	**4,149**	**4,429**	**3,319**	**3,543**
OECD Asia	**1,595**	**2,216**	**1,276**	**1,773**
Japan	1,054	1,247	843	998
South Korea	243	515	194	412
Australia/New Zealand	298	455	238	364
Total OECD	**11,506**	**13,594**	**9,205**	**10,875**

Emissions data from EIA, International Energy Outlook (2009), Table A-10.

examining whether global population and economic growth will accelerate emissions growth to swamp the effects of the demanded reductions, the focus now is on the simple question — what activities or combinations of activities will produce reductions of 3.9 or 4.7 gigatons in the U.S.? And, how achievable is that objective by 2050?

A gigaton reduction is the equivalent of:

- Doubling the miles per gallon of 273 million cars (from 20 to 40 mpg); or
- Building 273 "zero-emission" 500 MW coal-fired power plants; or
- Building 136 new nuclear power plants of 1 gigawatt each; or
- Installing 14-times the wind capacity presently available or 1 million 1 megawatt wind turbines; or
- Installing 273-times the current solar capacity; or
- Replacing petroleum-fuels with biofuels equivalent to the harvest from a an area two times the size of the United Kingdom (or 480,000 sq km); or
- Convert a barren area the size of Germany and France into new forest (over 900,000 sq. km.).

Meeting the G-8 standards would require doing four or five of these or some combination thereof in the United States in forty years. Nine or ten of these activities would be needed to meet the reduction target demanded of the rest of the OECD. Is that likely? No. It certainly would be expensive.

The G-8 declaration, like proponents of cap and trade legislation in the U.S., put great faith in the ability of government to directly or indirectly spur the creation and use of new technologies. Government can do much to intervene in the research and development process and sometimes successfully encourages innovative commercial outcomes. This history is not clear, however. Numerous government efforts have ended in failure, as well.

In the forty years that will pass between now and 2050, it is possible that new energy supply options or alternative fuels will be developed and cross into commercial viability, but that remains more a hope than a realistic outcome. The EIA projects that U.S. energy supplies still will be dominated by fossil fuels in 2030, with petroleum, coal, and natural gas supplying 80% of U.S. energy needs. The International Energy Agency reaches a similar finding. Both projections consider the range of possible alternatives and include remarkable rates of growth for those alternatives in their forecasts. In the end, burgeoning demand for energy (to sustain larger populations and growing standards of living worldwide) necessitate the continued use of fossil fuels.

Predicting the pace of technical innovation and the behavior of consumers four decades from now is an impossible task, but the facts suggest that the G-8's effort to constrain emissions faces a daunting challenge of supporting and completing an enormous level of activity to meet the nine to ten gigaton reduction demanded of OECD economies.

Notes

1. ***http://www.g8italia2009.it/static/G8_Allegato/G8_Declaration_08_07_09_final,0.pdf***
2. ***http://www.marshall.org/pdf/materials/585.pdf***
3. See ***http://cdiac.ornl.gov/ftp/trends/emissions/usa.dat*** for historical U.S. emissions data.