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## NEW SOURCES WILL DRIVE GLOBAL EMISSIONS

1/18/07 D R A F T

Provided to Energy Policy

By Hoff Stauffer

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### **Abstract**

Nearly all policy initiatives to mitigate climate change have adopted the cap and trade approach, perhaps because this approach has worked so well for reducing SO<sub>x</sub> and NO<sub>x</sub> from existing power plants in the US. However, new sources, not existing sources, will be primarily responsible for global CO<sub>2</sub> emissions in the 21<sup>st</sup> century, since new sources provide for growth and replace existing sources at the end of their useful lives.

### **Keywords**

Global climate change; CO<sub>2</sub> forecasts; new and existing sources

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**Introduction**

Nearly all policy initiatives to mitigate climate change have adopted the cap and trade approach, perhaps because this approach has worked so well for reducing SOx and NOx from existing power plants in the US. However, new sources, not existing sources, will be primarily responsible for global CO2<sup>1</sup> emissions in the 21<sup>st</sup> century, since new sources provide for growth and replace existing sources at the end of their useful lives.

This paper explores emissions from existing sources and from new sources over time and finds that new source emissions will dominate global emissions in the 21<sup>st</sup> century.

**Short Useful Lives**

Most energy-using devices (e.g., appliances, autos, electronic equipment) have useful lives less than 20 years. Hence, in 20 years, essentially all of these devices will be new sources relative today.

Exhibits 1a and 1b below show the percentage that new sources are of total capacity for assets of useful lives from 5 to 50 years. Exhibit 1a assumes no growth, and exhibit 1b assumes 5% growth.

Exhibit 1a

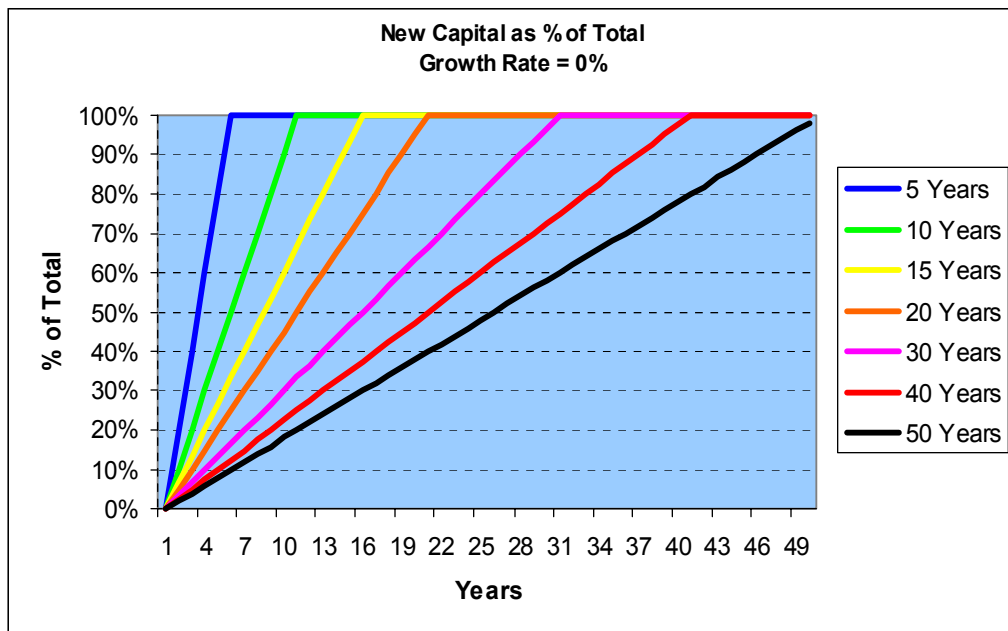
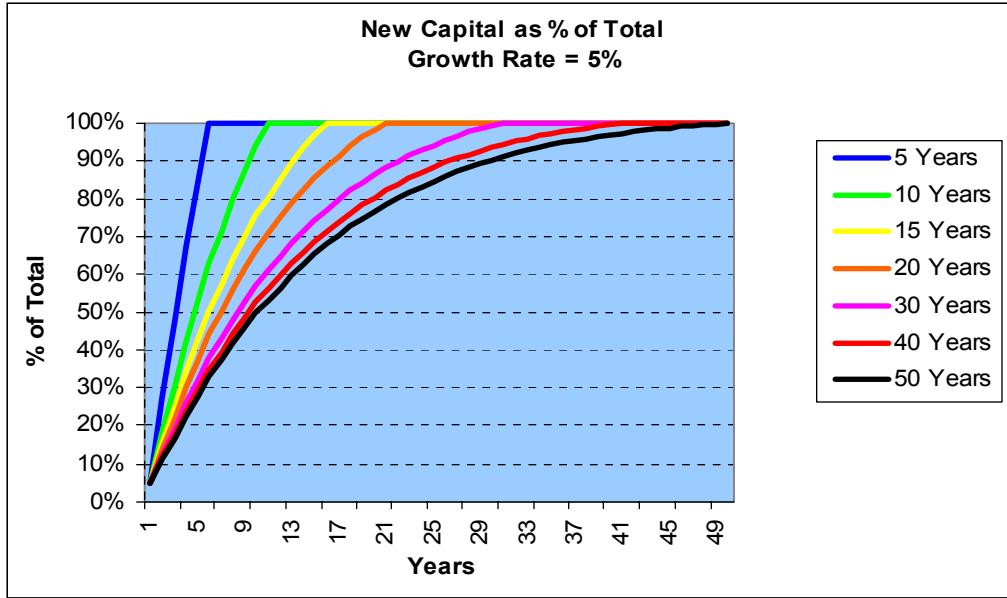


Exhibit 1b



After 20 years, even a substantial portion of the assets with longer useful lives are new sources. See Exhibit 2 below.

Exhibit 2

Percent New	Growth Rate	-----Useful Life-----				
		10	20	30	40	50
<b>After 10 Years in future</b>						
	0.0%	90%	45%	30%	23%	18%
	2.5%	92%	57%	45%	39%	36%
	5.0%	94%	66%	57%	52%	50%
<b>20 Years in future</b>						
	0.0%	100%	95%	63%	48%	38%
	2.5%	100%	97%	78%	68%	62%
	5.0%	100%	98%	86%	82%	77%
<b>30 years in future</b>						
	0.0%	100%	100%	97%	73%	58%
	2.5%	100%	100%	98%	87%	80%
	5.0%	100%	100%	99%	94%	90%
<b>40 Years in future</b>						
	0.0%	100%	100%	100%	98%	78%
	2.5%	100%	100%	100%	100%	92%
	5.0%	100%	100%	100%	100%	97%
<b>50 Years in future</b>						
	0.0%	100%	100%	100%	100%	98%
	2.5%	100%	100%	100%	100%	99%
	5.0%	100%	100%	100%	100%	100%

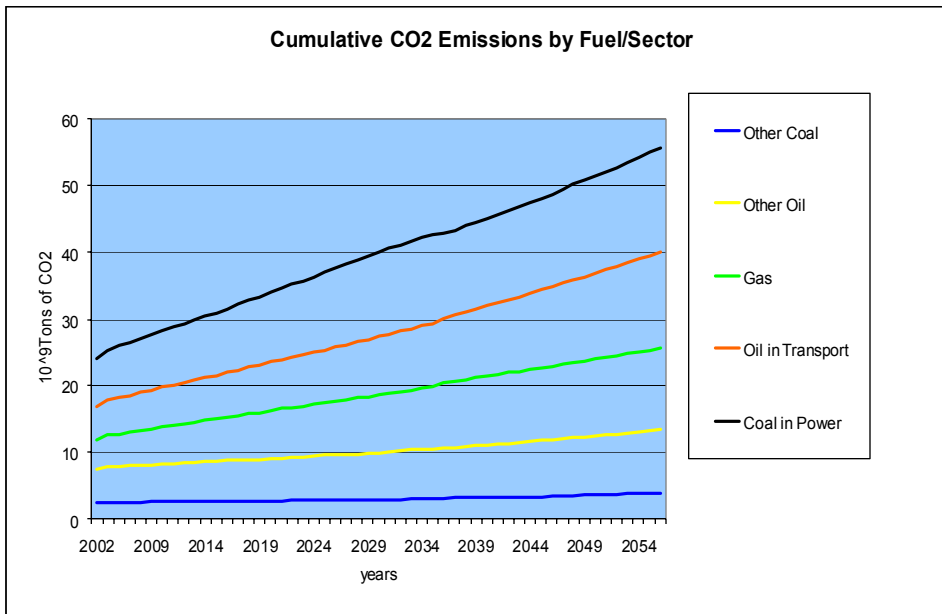
After 20 years, with 2.5% growth, 62% of the capacity with a 50-year useful life is new, and after 30 years, 80% is new.

New sources become a greater and greater percentage of total global emissions over time, even for the assets with longer useful lives. This is because new sources satisfy all the economic growth and they replace existing sources as they are retired at the end of their useful lives. It is not surprising that this happens, but it may be surprising that this happens so quickly.

**Longer Useful Lives**

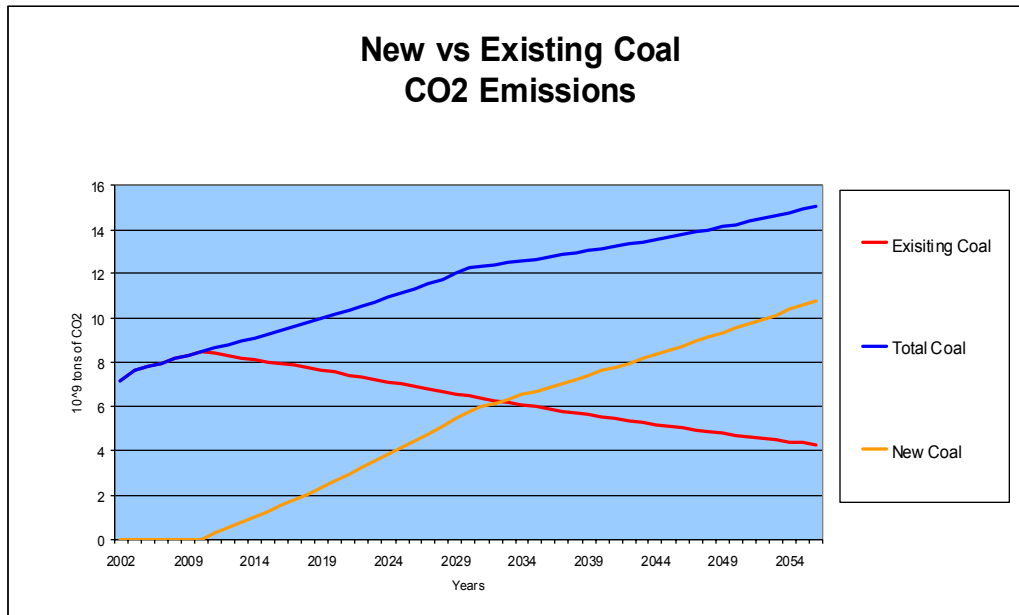
Coal-fired power plants are one of the two major sources of the growth in global CO2 emissions, in the reference case forecast.<sup>2</sup> The other major source is transportation. See Exhibit A3 below.

Exhibit 3



Essentially all of the transportation sector will be new sources by 2050, since the average useful life of an auto (or an aircraft engine) is less than 20 years. But coal-fired power plants have much longer useful lives. Yet, new sources represent 67% of total emissions from coal-fired power plants in 2050, based on conservative assumptions on existing plant retirements (1% to 2% per year).<sup>3</sup> See Exhibit 4.

Exhibit 4



The percentage of new sources would increase quicker if existing coal-fired power plants are retired sooner due to more stringent environmental regulations (for such pollutants as SO<sub>x</sub>, NO<sub>x</sub>, and mercury) or to policy initiatives that impose a mandatory retirement age.

### Conclusion

Clearly new sources will represent a greater and greater proportion of the total global emissions over time.

Further, these new sources have the most cost-effective options for reducing emissions and increasing efficiency. In contrast, mitigating existing sources can be very expensive. Retrofit costs are always higher than including the same technology in the design of a new source. The remaining useful life of the existing source is not as long as for the new source, resulting in a shorter period over which to amortize the higher capital costs. Also, replacing an entire existing source with a new source is almost always very expensive.

Accordingly, new sources, as opposed to existing sources, should be the primary focus of programs to reduce GHG emissions. The suitability of cap and trade versus other approaches for dealing with new sources is the topic of another paper.<sup>4</sup>

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<sup>1</sup> There are other greenhouse gases (GHGs) in addition to CO<sub>2</sub>. The most significant of these are methane and black carbon (or soot). Meaningful reductions in the other GHGs could likely be done sooner and cheaper than reductions in CO<sub>2</sub> emissions. Such reductions are a necessary but not sufficient element of any strategy to mitigate global climate change. This paper (and most of the global climate change debate) focuses on CO<sub>2</sub>, because it represents the most formidable challenge. But the other GHGs should not be ignored.

<sup>2</sup> These forecasts were developed using the Global CO<sub>2</sub> Forecasting Model, developed by the author. The reference case forecast thru 2030 is the same as that in the 2004 World Economic Outlook by the International Energy Agency. The mitigation options were developed by the author and are explained in Economics of CO<sub>2</sub> Mitigation presented at the EUCI Conference in Miami, December 6, 2005, available upon request.

<sup>3</sup> Ibid

<sup>4</sup> Hoff Stauffer, "A New Standard for Preventing Global Warming" (Silver City, NM and Washington, DC: *Foreign Policy in Focus*, October 4, 2006)