Ocean Protection Crucial for the Global Climate

The United States sets New Standards of CO_2 Reduction

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In June 2014, the U.S. Environmental Protection Agency EPA presented the "Clean Power Plan" with emission controls for reducing the climate impact of electricity generation and usage. The special evaluation of carbon dioxide (CO_2) also makes this rule an exemplary international guideline.

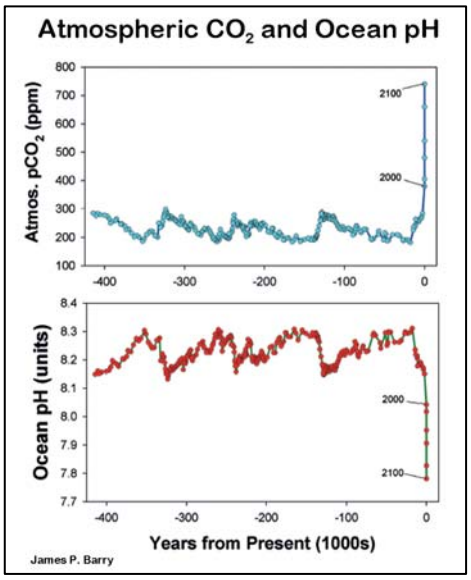
By 2030, CO_2 emission levels in the U.S. electricity sector are to be reduced by 30% compared with 2005, mainly by restricting coal power generation. All states are responsible for individual or regional target fulfillment.. In the Midwest, electric power is mainly produced by CO_2-intensive coal-fired plants that now require modernization or retirement. In other cases, efficiency measures and low-carbon power generation using fossil fuels, renewable energies, and nuclear technologies will be expanded.

Since the end of the 20th century, most new U.S. power plants have already employed natural gas. In California, maximally 499 kg of CO_2 per megawatt hour (MWh) was prescribed in 2007 for electricity trading, corresponding to the emissions produced by a gas power plant.

CO_2-induced climate and health risks

The "Risky Business Project" was founded in 2013 under the chairmanship of Michael Bloomberg and other U.S. financial experts. In an initial analysis, CO_2-related costs amounting to tens of billions of dollars per year have been estimated from crop failures, storm damage, rising sea levels, and health detriments. The U.S. Conference of Mayors therefore advocates the enactment of an Emergency Climate Protection Law, with a Federal Climate Protection Board convened to treat increasingly urgent developments throughout the economy.

For instance, particular coastal fishery operations are already negatively affected by ocean acidification, the CO_2-induced loss of seawater alkalinity. Ocean pH levels are now declining 100 times more rapidly than at any other time over the last 300 million years. Marine environments have become global seismographs for the detrimental effects of fossil fuel usage.



Mercury Pollution Limitations

A major concern of U.S. environmental policy is the protection against heavy metals. According to the 2011 MATS (Mercury and Air Toxics Standards) directive, flue gas mercury reductions of over 90% are required.

Modernized coal plants of about 250 gigawatts (GW) capacity will comply with MATS requirements, while older installations (60 GW) are being retired by 2020. Strict limits for mercury are therefore simultaneously contributing to CO_2 reductions.

Without comparable regulations, mercury emissions in many European lignite (brown coal) power stations exceed one kilogram per day.

CCS for increased oil revenues

Under EPA emission controls, it is nearly impossible to plan a new coal power plant in the United States without carbon capture and storage (CCS). However, this downstream process is generally not cost-effective without subsequent utilization, such as by injecting CO_2 into nearly depleted oil fields to enhance residual extraction.

Burning these additionally produced hydrocarbons nevertheless emits more CO_2 than what had been previously stored underground. CCS therefore transforms captured carbon dioxide into increased net emissions in the transport sector.

CO_2 in the List of Pollutants

Instead of being treated as a harmless trace gas, carbon dioxide is defined in the EPA Clean Power Plan as a pollutant. This legally binding interpretation was confirmed in 2012 by the United States Supreme Court.

However, CO_2 only partially contributes to climate change, which is also affected by other greenhouse gases, land use, and polar ice cover. Partial benefits such as extended growing seasons in northern countries also diminish the total economic losses ascribed to global warming.

By contrast, the formation of carbonic acid from absorbed carbon dioxide is entirely responsible for acidification (reduced alkalinity) of the oceans. The atmospheric CO_2 concentration of 402 ppm is currently rising by 3 ppm per year at an accelerated rate. Attaining a level of 560 ppm will cause the present ocean pH value of 8.06 to decline to 7.95, exceeding the adaptive capability of many calcifying species.

The foreseeable disruptions of marine biological equilibrium by the middle of this century make a pre-emptive reduction of carbon emissions an overriding priority for the energy sector. The responsibility of CO_2 for ocean acidification is compared with the effects of climate change in the following table, under simplified assumptions.

Global Carbon Influences			
Pollutant Effect		Climate Change	Ocean Acidication
Planetary scale		100 %	71 %
Incidence threshold, 402 ppm CO_2 in 2014		450 – 800 ppm	520 – 560 ppm
Year of incidence at ~ +3 ppm CO_2/a		2030 - 2080	2040 - 2050
Contribution to threshold effect	Clouds & water vapor H_2O	36 – 72 %	0 %
	Carbon dioxide CO_2	9 – 26 %	100 %
	Methane CH_4	4 – 9 %	oxidation to CO_2
	Ozone O_3	3 – 7 %	0 %
Ratio benefits / detriments		< 1	<< 1
Compensation	Biomass CCS	✓	X
	Reforestation	✓	X
	Global engineering	✓	X
Accommodation		adaptation	local buffering

In result, carbon dioxide is the single most important environmental contaminant. The EPA's definition as a pollutant should therefore be applied as a standard for all future CO_2 reduction strategies. Ongoing global warming would otherwise contribute to carbonate dissolution in stony corals and crustaceans due to the increased reactivity of seawater. The reduced productivity of shellfish and fishery operations could permanently threaten protein availability for several billion people before the end of the century.

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