

“Action, Action, Action” Needed to Fight Climate Change

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What’s needed is “action, action, action,” California’s Republican governor, Arnold Schwarzenegger, told the assembled presidents and premiers at the U.N. Climate Summit in September. This article, the third in this climate change series, will examine the scope of global action required to slow climate change to manageable levels.

“Global warming is a reality. Innovation in energy technology and policy are sorely needed if we are to cope,” explained Gary Stix, senior editor at Scientific American. But to slow climate change so our children and grandchildren will inherit a livable planet, mankind must dramatically reduce global greenhouse gas (GHG) emissions. There is broad consensus among climate scientists that today we are very near the maximum safe atmospheric concentration of GHG and to prevent the atmosphere from filling up with additional GHG, sharp cuts in emissions must occur worldwide. Mainstream scientific estimates specify that the US, the world's largest GHG emitter, must cut its GHG emissions by 70 percent to 85 percent by 2050 for the world to have a chance to stay below the critical threshold.

While an 85 percent cut in GHG emissions sounds overwhelming, methods to achieve aggressive goals are the object of intense study in universities and industrial research labs. Climate scientists think about combining many different actions, each contributing part of the necessary GHG reduction, to create a global solution to reduce GHG emissions.

Choose Eight Out of 17

Robert H. Socolow and Stephen W. Pacala of Princeton University pioneered this thinking with the concept of a stabilizing wedge – a specific, individual technological or social action that would reduce GHG emissions by one billion tons annually over 50 years. In the remainder of this article we will present 17 different possible actions, each capable of delivering one eighth of the total solution needed. None of these actions are simple or easy; many we don’t even know how to do today, but all are considered possible with the technological innovation we can expect in the next 50 years.

Certainly choosing among these potential actions will be difficult. Groups will fight actions that affect them, and conflicting priorities will create confusion that delays action. But the need for action was reiterated by the final report of the UN International Panel on Climate Change (IPCC), the most thorough scientific analysis of climate change, which concluded the situation was already "so severe and so sweeping that only urgent, global action" could head off the crisis.

Efficiency and Conservation

1. Increase fuel economy of two billion cars from 30 to 60 mpg. (There aren't that many cars in the world right now, but there may be in 50 years.)
2. Drive two billion cars not 10,000 but 5,000 miles annually.
3. Cut electricity use in homes, offices, and stores by 25 percent. Improved efficiency of appliances and lighting will help, but substantial improvements in heating and air conditioning systems will be required to achieve this much savings.

Power Generation

4. Raise efficiency of 1,600 large coal-fired electric power plants from 40 percent to 60 percent. Although coal generation efficiency has been gradually improving, achieving this efficiency on a production scale is beyond current technology.
5. Replace 1,400 large coal-fired plants with gas-fired plants. Using natural gas to generate electricity produces far less GHG than using coal, but such a large-scale switch to natural gas would dramatically affect prices and markets, and the supply of so much natural gas is not assured.

Carbon Capture and Storage (CCS)

Climate change could be slowed if somehow the GHG from burning fossil fuels could be captured and stored, instead of released into the atmosphere. As simple and direct as this sounds, and although such technology is the subject of very active research, CCS is still only a concept and not available for power plants today.

6. Install CCS at 800 large coal-fired plants.
7. Install CCS at new coal-fired plants to produce hydrogen for 1.5 billion vehicles. This would require completely replacing the petroleum fuel infrastructure for automotive transportation, including developing ways to transport and store hydrogen which is not possible today.
8. Install CCS at new coal-to-syngas plants to produce the equivalent of one third of today's petroleum production.

Alternate Energy Sources

9. Double today's nuclear output to displace coal. In addition to building new nuclear plants, this would require building replacements for today's aging nuclear plants, and it would require building nuclear waste storage facilities.
10. Increase wind power 4,000 percent (about one million additional wind turbines) to displace coal generation of electricity. New technology would be required to store the variable electric output of wind turbines to deliver electricity on demand.

11. Increase solar power 70,000 percent (about 10,000 square miles of photovoltaic panels) to displace coal generation of electricity. Like wind, new technology would be required to store the variable electric output of solar photovoltaic to deliver reliable electricity on demand.

12. Increase wind power 8,000 percent (about two million additional wind turbines) to make hydrogen for cars. This would require completely replacing the petroleum fuel infrastructure for automotive transportation, including developing ways to transport and store hydrogen, which is not possible today.

13. Drive two billion cars at 60 MPG on ethanol. This would require an estimated 15 percent to 20 percent of the world's cropland, and would certainly decrease global food availability.

Agriculture and Forestry

14. Stop all deforestation. Although not sustainable, much of the developing world's economy currently depends on deforesting industries and slash-and-burn agriculture.

15. Use conservation tillage on 100% of global cropland. Such a global change would have other significant but mixed impacts, including better water conservation, increased use of herbicides, decreased yields, and increased demand for new hybrid or GMO seeds.

Population and Lifestyle

16. 275 million people (about as much as the entire US population) become vegetarians. Producing meat releases significantly more GHG than producing an equivalent amount of vegetable food, however such a social change cannot be legislated.

17. Reduce the population increase in the developing world by one billion over the next fifty years. The population of the developed world is estimated to remain near the same at 1.2 billion people from 2000 to 2050, but the population of the developing world will explode from 4.9 billion to 8.2 billion people in the same period. Decreasing the growth of world population is the most direct way to limit the increase of GHG emissions, but population growth is woven into the social fabric of much of the developing world.

GHG Reduction Possible

While there is broad agreement that achieving an 85 percent reduction in GHG emissions will be difficult, there are examples of similar successes. Typical 1950s new cars emitted 13 grams of hydrocarbons (HC), 3.6 grams of nitrogen oxides (NO_x), and 87 grams carbon monoxide (CO) per mile. By 1994, typical new cars emitted only 0.25 gram HC, 0.4 gram NO_x, and 3.4 grams CO per mile.

As a result of political and social will, in less than 50 years engineering breakthroughs reduced auto emissions for HC by 98 percent, NO_x by 88 percent, and CO by 96 percent. There is every reason to believe we can make the necessary GHG cuts if we can create the political and social spirit to demand success.

GHG Reduction Affordable

The costs of runaway global warming have been estimated and are huge. The most complete report to date, compiled by Nicholas Stern, former chief economist at the World Bank, estimates that unchecked climate change will result in global recessions shrinking the world economy by 20 percent, while the costs to take action now to curb climate change would be just 1 percent.

The IPCC reached a similar conclusion, estimating a global cost to reduce climate change to manageable levels at only a 3 percent cumulative reduction in economic growth by 2030. The conservative journal, *The Economist*, says these are costs “the world would barely notice” and calls tackling climate change a bargain, but cautions, “No country alone can make a difference, and it is in every country’s interest to ensure that everybody else bears the burden. As the IPCC report convincingly argues, the technology and the economics of this problem are easily soluble. It is the politics that is so difficult.”

Sidebar: The Efficiency Paradox

Many of the actions identified to cut GHG emissions rely on increased efficiency of cars, appliances, and buildings and assume a proportional GHG reduction. However, there is historical evidence that increased efficiency and the associated cost savings just makes people use more energy. Jeff Rubin of Canadian Imperial Bank Commerce (CIBC) World Markets concluded, “instead of capping energy demand, what we observe is that improvements in energy efficiency lead to ever and ever-greater levels of energy usage.”

How American’s use their cars is an example of this paradox: Since 1980 the average mileage per gallon for a given type of vehicle, has improved by 30 percent, but the fuel consumed per vehicle has remained constant because we responded by driving more and by driving larger vehicles.

Sidebar: US Political Will On Climate Change Increases

After years of confusion and denial, there are signs of increasing federal will to halt climate change.

On December 6th, the Senate Environment Committee advanced a bill to be considered by the full Senate early in 2008 that would cut greenhouse gas emissions by 70 percent by 2050. The bill has bipartisan support including committee chair Barbara Boxer (D) and John Warner (R) and was supported by every major environmental group and many business.

On December 15th, at UN climate talks in Bali, the United States dramatically dropped opposition to a proposal by the main developing-nation bloc, the G77, for rich nations to do more to help developing world fight greenhouse emissions.

On December 20th the Federal Energy Bill became law that increases the fuel-efficiency standards for cars for the first time since 1975, increases the uses of renewable biofuels, and includes new rules and incentives to encourage greater efficiency buildings. (To avoid a threatened Presidential veto, the final version of the bill dropped incentives and

tax credits for renewable energy, and a requirement that utilities generate 15 percent of their power from renewable sources.)