

Chinese leadership can save humanity in the fight against global warming. But fossil-fuel companies must be forced to pay for their carbon emissions, writes **James Hansen**

# The price of change

**T**he climate crystal ball is clear – the physics undeniable. Burning all fossil fuels (coal, oil, gas) would have staggering consequences, even threatening humanity's survival. Fossil fuels produce carbon dioxide, which stays in surface reservoirs – the atmosphere, ocean, soils and biosphere – for millennia. Climate response to carbon dioxide begins slowly, because of the inertia of the ocean and the ice sheets on Antarctica and Greenland.

That inertia is not our friend. It means there is warming still "in the pipeline". We have seen only about half of the eventual global warming due to carbon dioxide already in the air. Global warming so far is equivalent to the earth having the sniffles. Pakistan's unusual floods. Moscow's record heat. South China's drought followed by flood. People can struggle through such climate "inconveniences". The big problems wait for our children – if we do not rapidly phase down carbon dioxide emissions.

Sea level rise is one problem. Carbon dioxide amounts of 400ppm (parts per million), expected in 2016 with current emissions, will cause an eventual sea level rise of about 25 metres. China's land area will shrink greatly, requiring about 250 million people to move inland.

How rapidly ice sheets will collapse is uncertain. A sea level rise of one metre every 20 years has occurred in past ice sheet disintegrations. But the human-made climate forcing is far greater and faster than past natural forcings. Ice shelves – tongues of ice protruding into the ocean and buttressing the great Antarctic and Greenland ice sheets – are melting. Both ice sheets are now losing over 100 cubic kilometres of ice each. If mass loss continues to accelerate, ice sheet collapse may begin within decades.

Species extermination – euphemistically called "loss of biological diversity" – is a second irreversible problem. The rapid poleward shift of climate zones, now moving 50-60 kilometres per decade, will be the primary cause of continuing extinctions. Many species cannot migrate rapidly. As some species falter, ecosystems can collapse because of species interdependencies. Passing a tipping point could cause mass extinctions, as occurred several times in earth's history. New species evolved after prior mass extinctions, over millions of years. But if we drive fellow species to extinction, we will leave a far more desolate planet for as many generations as we can imagine.

China is not mainly responsible for human-made climate change, which is proportional to total historical emissions. The United States is responsible for 27 per cent, China for 9.5 per cent. But China has the largest emissions today and will become the principal cause of global

climate change within two decades, if current rapid increases of coal use continue. Governments must recognise this stark fact: burning all fossil fuels would increase carbon dioxide to more than 550ppm and create a different planet – a desolate, ice-free planet with sea levels 75 metres higher than today.

The transition to the ice-free state will be chaotic and out of humanity's control, if the ice sheets' tipping point is reached. Stable shorelines may not occur again until all the ice is gone.

How can climate tipping points be avoided? The strategic requirement is clear: we must phase out coal emissions and leave unconventional fossil fuels such as tar sands in the ground. Atmospheric carbon dioxide amounts will subside slowly as carbon mixes among surface reservoirs.

That strategic path makes sense. Coal and tar sands are the dirtiest fuels on the planet, poisoning the air, land, lakes and oceans with mercury, arsenic and other dangerous chemicals.

Fossil fuels are finite, so we must move at some point to carbon-free energies such as nuclear power, renewable energies and improved energy efficiency. Preserving a future for young people requires phasing out fossil fuels over the next several decades.

Everybody should prefer a brighter future with clean, carbon-free energies rapidly supplanting dirty fossil fuels. But what is actually happening? Coal use is surging worldwide. Tar sands are being developed by Canada, Norway and the US.

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peril" and pretend that their policies are aimed at stabilising the climate. This is called "greenwash". In the most generous interpretation, governments are well-meaning but ignorant of basic facts.

The most fundamental fact, as certain as the law of gravity, is this: as long as fossil fuels are the cheapest energy, they will continue to be burned. Fossil fuels are

cheapest only because they are not made to pay their costs to society. Health costs caused by air and water pollution are borne entirely by the public. The fossil fuel industry is not made to pay medical bills or compensate for lost productivity.

The greatest uncompensated cost is caused by climate change. Climate costs are already substantial, but future costs for today's youth will be astronomical.

These facts expose the crucial element of a solution for the energy and climate problem. A steadily rising carbon fee must be collected from fossil fuel companies.

All funds should be distributed monthly to the public on a per capita basis to allow lifestyle adjustments and spur clean energy innovations. As the fee rises, fossil fuels will be phased out, replaced by carbon-free energy and efficiency.

This fee-and-dividend approach provides the most rapid, economically efficient path to a clean energy future. It is the cure to fossil fuel addiction.

Wait a minute! If a carbon fee makes economic sense and saves the planet, why is the US, for example, not following that path? Fossil fuel interests reign in Washington and other capitals. Big money forces legislatures to hatch ineffectual schemes such as "cap-and-trade-with-offsets", a system designed by big banks

and fossil fuel interests that assures continued fossil fuel addiction.

Is there any hope, if most nations delude themselves with greenwash, of stopping rule by fossil fuel interests? Yes. China is the best hope. China now leads the world in clean energy investments – nuclear, wind and solar power. But these carbon-free energies will supplant fossil fuels, in China and the world, only when a rising carbon fee forces fossil fuels to pay their costs to society. No nation will impose an internal fee that seriously disadvantages itself in international commerce. But an internal fee-and-dividend system, with a modest initial carbon price, will be a boon to the nation that leads, and provide a framework for international discussion.

Climate change will soon emerge as the great moral issue of the 21st century, a matter of intergenerational justice. China, with a rational approach, can lead the world through the most dangerous crisis that humanity and nature have ever faced.

**James E. Hansen writes here as a private citizen. He provides a more comprehensive discussion in his recent book, Storms of My Grandchildren: The Truth About the Coming Climate Catastrophe and Our Last Chance to Save Humanity**

