

You can't do it all with mirrors



A costing for a giant sunshade in space shows that there are probably better ways to spend the money.

Philip Ball

The leading economist Nicholas Stern has just handed us, in advance, the bill for the impacts of climate change: close to \$4 trillion by the end of this century¹.

And with perfect timing, astronomer Roger Angel of the University of Arizona has delivered the equivalent of a builder's estimate for patching up the problem using a cosmic sunshade². It will set us back by... well, let's make it a nice round figure of \$4 trillion by the end of the century.

Both figures are rough estimates — when costs add up to a significant fraction of global GDP no one can expect them to be very accurate. But this happy conflux of figures puts some perspective on the hope that global warming can be addressed with high-tech mega-engineering projects.

In this context, the sunshade solution looks like a bad bargain. If a builder told you that the cost of fixing a problem with your roof was likely to be about the same as the cost of not fixing it, except that the fix was untested and might not work at all, and in any event you know the work is likely to run over budget and probably over schedule — well, what would you do?

One could argue that in this case the 'problem' involves the potential suffering of millions of people — in which case you might conclude that investing in a risky technofix can be justified on humanitarian grounds.

But Stern's report, commissioned by the UK government and hailed by many other economists as the most definitive study of its sort to date (see ['How much will it cost to save the world?'](#)), makes some estimate of the likely costs of tackling climate change using existing approaches and technologies - and the answer looks cheaper and a whole lot more attainable than Angel's sunshade.

In the shade

That doesn't mean Angel's proposal is without value. On the contrary, it performs the service of showing just what would be involved in pursuing one of the favourite ideas of those who believe technofixes are the answer to saving us all.

A space shade that reduces the amount of sunlight reaching the Earth has been debated for decades. Angel has found inventive ways of coping with all the challenges while keeping costs down. To minimize radiation pressure and stop the sunshade from moving in space, his screens would deflect sunlight through only a small angle, just enough to miss the Earth. To keep it in place, it would be installed carefully 1.5 million kilometres away, where it would orbit the Sun with the same one-year period as our planet.

The overall size of the required screen would be mind-boggling: about 4-6 million square kilometres, around half the area of China. But to avoid complicated space-assembly problems, and to simplify the launching and increase the screen's versatility, Angel proposes that it should consist of a vast swarm of 1-metre disks, made from lightweight ceramics. Each of these 'flyers' is manoeuvrable thanks to tiny solar sails placed on tabs at the rim, powered by solar cells.

As usual, science fiction got there first. In a short story by Brenda Cooper and Larry Niven published in 2001, an alien species wipes out another by deploying a fleet of tiny mirrors around their planet, plunging it into an ice age³ — a reminder, perhaps, that we'd better not overdo the shadowing.

Angel's flyers would be launched in stacks, like piles of Brobdingnagian dinner plates, packaged into canisters and fired into space from electromagnetic guns more than a kilometre long. Twenty such cannons would fire 1-tonne payloads every five minutes for ten years. Once in space, the flyers would make their way to the right spot using ion thrusters, where they spread out into a cloud as wide as the Earth and 100,000 kilometres long.

Mind boggle

All this sounds a long way from the sober accounting of the Stern report. But Stern's numbers are equally mind-boggling.

Stern says that the impacts of climate change could end up costing the world up to 20% of its annual GDP — comparable to the world wars or the Great Depression.

The good news is that cutting emissions, along with improvements in energy efficiency, stopping deforestation and switching to non-fossil-fuel energy sources, will cost some 1% of global GDP over the next 50 years.

It will require international co-operation (which is one reason that critics have scoffed). And how, exactly, it can be done — be it through solar cells on roofs or new nuclear power — is still very much up for debate. But at least the builder's estimate looks to be a better deal,

and doesn't rely on a single untested plan. Plus it aims to deal with all the problems of climate change, including the growing acidity of the ocean, for example, rather than just the temperature of the air.

But Angel has done us the great favour of showing that there is probably never going to be the option of conducting business as usual under the shelter of a gigantic technofix.

Visit our [cantdoitallwithmirror.html">newsblog](#) to read and post comments about this story.

References

1. Stern Review on the Economics of Climate Change (HM Treasury, London, 2006); at , http://www.hm-treasury.gov.uk/independent_reviews/stem_review_economics_climate_change/stem_review_report.cfm (2006).
2. Angel R. *et al.* Proc. Natl Acad. Sci. in press (2006) [doi:10.1073/pnas.0608163103].
3. Cooper B.& Niven L. "Ice and Mirrors", in Asimov's Science Fiction, February (2001).