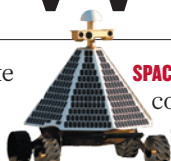


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Heavy smog shrouded advertising boards in Tiananmen Square, Beijing, last month.

ENVIRONMENT

Fight against smog ramps up

Chinese government to provide incentives for heavy polluters to go green, but analysts question whether its wider air-quality strategy goes far enough.

BY JANE QIU

After decades of breakneck economic development, China is being plagued with choking pollution on an unprecedented scale. The smog over many cities reached new levels in the run-up to Chinese New Year on 31 January, creating havoc for holiday travellers. The government advised citizens to refrain from using fireworks and to stay indoors.

But change is in the air. On 12 February, China's cabinet announced that the government will implement a series of measures aimed at shifting the primary energy source from coal to natural gas and renewables; place tougher controls over emissions; and set up a 10-billion-renminbi (US\$1.7-billion) fund to help companies to meet new environmental standards. A key feature will be an emphasis on using economic incentives — such as

pricing mechanisms that favour cleaner alternatives to coal and crude oil, as well as taxation and requirements for investors to support only green energy companies — to encourage industry to reduce emissions and to foster the development of clean technologies, the cabinet said in a statement.

The announcement forms part of an ambitious 1.7-trillion-renminbi scheme to drastically improve air quality across China by 2017. The targets of the initiative, announced last September, include cutting atmospheric levels of PM10 — particulate matter with a diameter of 10 micrometres or less — in all major cities by 10% from the 2012 level. The government also aims to reduce the proportion of coal used in power production by nearly 2%, to improve fuel standards, to phase out highly polluting vehicles and to limit the number of cars in big cities.

Tougher targets have been set for three particularly smog-ridden regions: the Greater

Beijing area, the Yangtze River Delta in eastern China and the Pearl River Delta in Guangdong province. By 2017, each must reduce its atmospheric levels of the finer PM2.5 — by 25%, 20% and 15%, respectively. “This will require a regional approach” rather than leaving individual cities to their own devices, said Zhai Qing, a vice-minister for environment, last week.

Although no details have been released about how the targets will be met, researchers say that the scheme is by far the toughest and the most ambitious in China's efforts to curb pollution. “This is the first time China has put a limit on absolute emission levels,” says He Kebin, who studies air-pollution control at Tsinghua University in Beijing. Previous schemes were aimed at reducing emission intensities — the amount of emissions per unit of gross domestic product. “Although emission intensities continue to decrease, the fast economic development means that the total ▶

► levels are still on the rise,” he says.

To meet the targets, “China must switch from a model of economic development at all costs to one that is much more sustainable”, adds He. “This is a unique opportunity to make that transition.”

But the switch will not be easy, says Ma Jun, director of the non-governmental Institute of Public and Environmental Affairs in Beijing. “The resistance from industry groups and some government agencies will be fierce because of vested interest.” Ma adds that institutional reforms and amendments to environmental laws will be crucial to the scheme’s success.

At the moment, the environment ministry is powerless to act against many polluters, which often ignore it or happily pay fines that have little effect on their profits. The ministry “is seriously under-resourced”, says Michael Walsh, founding chair of the International Council on Clean Transportation, a non-profit organization headquartered in Washington DC. The Chinese ministry has, for instance, only a few dozen staff to safeguard air quality. By comparison, the US Environmental Protection Agency has more than 1,000, Walsh says.

Analysts expect the government to reorganize ministries substantially at the annual meeting of the National People’s Congress next month. Measures are likely to include slimming down powerful agencies such as the National Development and Reform Commission and the Ministry of Land and Resources, and granting the environment ministry more power and resources. Also on the agenda are

“The resistance from industry groups and some government agencies will be fierce because of vested interest.”

amendments to the 1989 Environmental Protection Law and the 1987 Atmospheric Pollution Prevention Act. These are expected to allow the environment ministry to impose much heavier fines on heavy polluters, veto projects that fail to address environmental impacts and shut down persistent offenders.

Political issues aside, certain scientific questions must be resolved urgently to ensure that the targets for 2017 are met, researchers say. “Air pollution in China is extremely complicated,” says Zhu Tong, an atmospheric chemist

at Peking University in Beijing. Smog can be caused by vehicle emissions, the burning of coal and biomass, dust and rubbish incineration. “It’s unclear how their relative contribution is different in each city and varies from season to season.”

As China prepares to use economic incentives and legal measures to curb pollution, it is also “making encouraging strides in promoting transparency of pollution information”, says Ma. Nearly 200 cities across the country currently release air-quality information in real time, and that is set to increase to all 338 major cities next year. The environment ministry publishes a monthly list of the most polluted cities, which can affect housing prices, hit tourism and investment and provoke public outcry. Since January, the ministry has also rolled out a national monitoring system that requires more than 15,000 heavy polluters to post on the Internet their real-time emissions and discharges into rivers.

“When the information is out in the open, the polluters will be forced to act,” says Ma. “The public is the strongest ally in the battle against air pollution.” ■

ASTRONOMY

Missing galaxy mass found

Gravitational lensing solves puzzle from the Big Bang’s echo.

BY EUGENIE SAMUEL REICH

Soon after the Big Bang, there were tiny ripples: quantum fluctuations in the density of the seething ball of hot plasma. Billions of years later, those seeds have grown into galaxy clusters — sprawling groups of hundreds or thousands of galaxies bound together by gravity.

But there seems to be a mismatch. Results released last year suggest that as much as 40% of galaxy-cluster mass is missing when compared

with the amount of clustering predicted by the ripples¹. The findings have led theorists to propose physics beyond the standard model of cosmology to make up the difference. But a reconciliation could be in the offing, using improved measurements of the cluster masses.

The mismatch was first detected by the European Space Agency’s Planck spacecraft, which measured the fluctuations imprinted on the cosmic microwave background radiation left over from the Big Bang and compared them with clusters that it could see. “A lot of

us are intrigued” by the discrepancy, says David Spergel, an astrophysicist at Princeton University in New Jersey, who studied the cosmic microwave background with Planck’s predecessor, NASA’s Wilkinson Microwave Anisotropy Probe. “There’s something missing in our understanding.”

Some theorists have played with the characteristics of neutrinos — ghostly, nearly massless subatomic particles — as a way of compensating. On 6 February, for example, physicist Wayne Hu of the University of Chicago in Illinois and his colleagues published² a theory that the mismatch could be bridged if the three known types of neutrino were significantly heavier than thought, or if there were a fourth, as yet undiscovered species of neutrino. The extra neutrino mass would have had an effect on the growth of the primordial ripples, evening them out and resulting in fewer clusters being observed today.

Now two studies, one in preparation and one posted on the arXiv preprint server on 11 February³, suggest that clusters actually have more mass than Planck estimated — and thus



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