

The international perspective

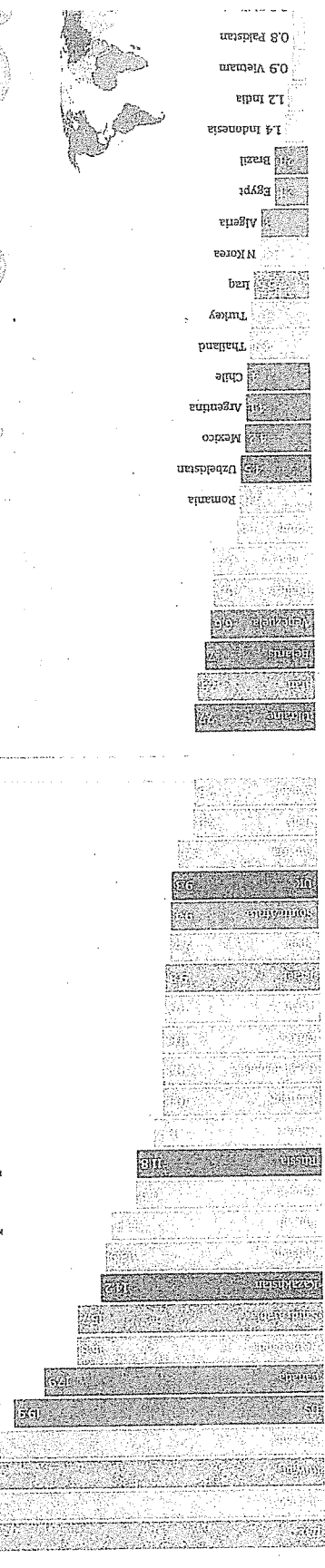
World carbon emissions

million tonnes of carbon f
consumption of fuel for 2e
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Carbon emissions
are still high
These figures from
the authoritative US Energy
Information Administration
report show carbon emissions by



Carbon emissions per capita (tonnes)



The Guardian 28 April 2010

INSIDE

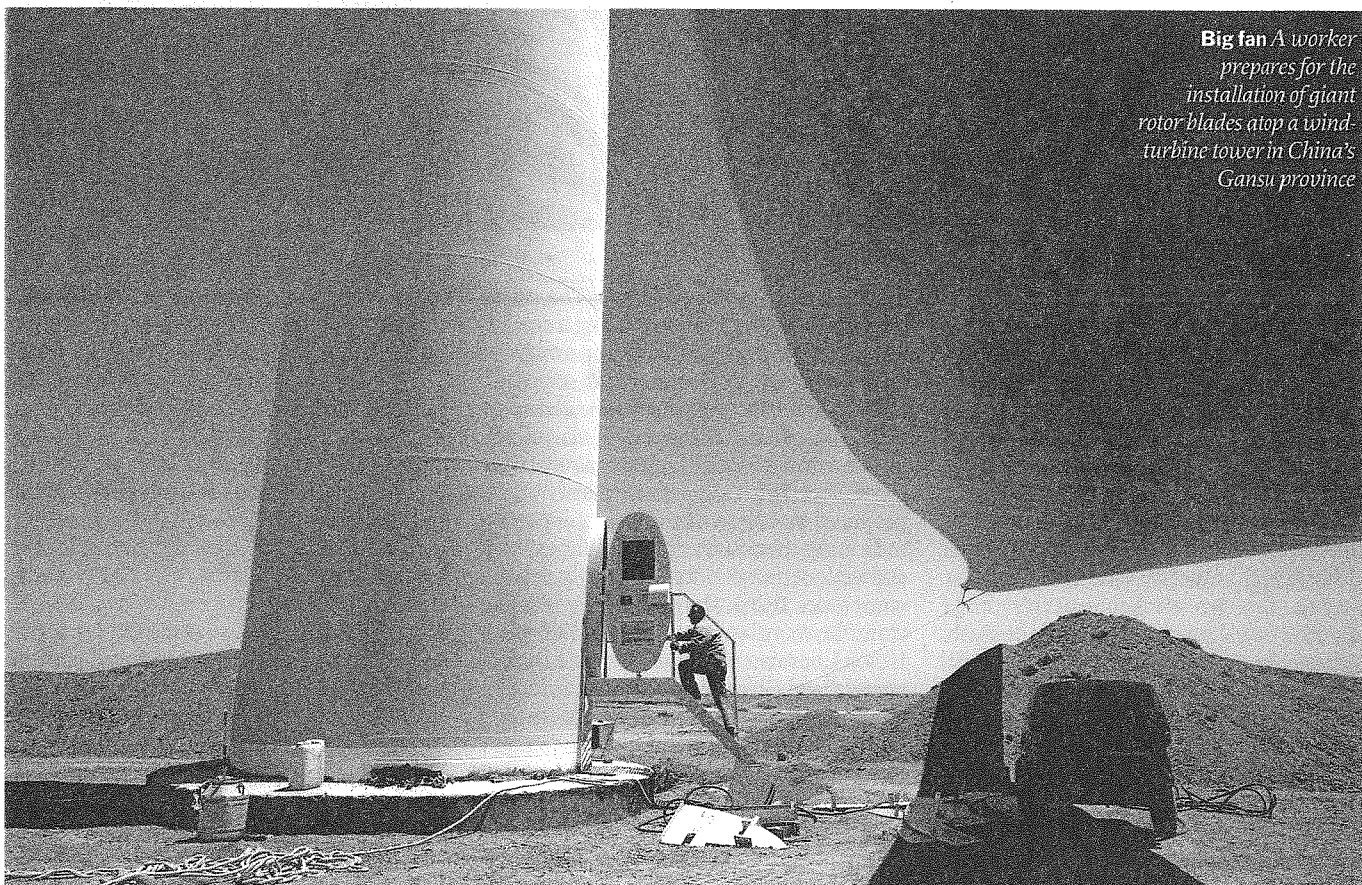
'Using barter we've purchased everything from air-conditioning units, computers and desks to lorries, forklifts and security gates.'

REG BURROWS, MEMBER OF THE BARTECARD TRADING NETWORK

Global Business

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Big fan A worker prepares for the installation of giant rotor blades atop a wind-turbine tower in China's Gansu province



ENERGY

Tower of Power.

 China is fast becoming one of the world's largest alternative-energy markets. But will foreign firms be welcomed?

BY AUSTIN RAMZY

IN CHINA, ONE DOESN'T HAVE TO LOOK far to see the country's commitment to renewable energy. In cities such as Beijing and Shanghai, rooftops are now covered with solar water heaters. On the grasslands of Inner Mongolia, towering white wind turbines are popping up where only cattle, sheep and herders on horseback once roamed. While coal consumption is

expected to climb more than 3% annually for the next two decades, the government has also required that electrical companies add a significant amount of alternative energy to their portfolios. With the global economy languishing, China—which is not only the world's most populous country, but also the most polluted—offers the promise that its green-energy drive can become a major source of demand for international wind and solar companies.

That expectation was given a boost in September when First Solar, the Arizona-based solar-module manufacturing giant, announced that it had landed a deal to build a solar field bigger than Manhattan near the city of Ordos, Inner Mongolia. The project will dwarf the largest solar plants to date, and eventually generate enough electricity to power the equivalent of 3 million Chinese homes. To fulfill the huge demands, First Solar says it's considering

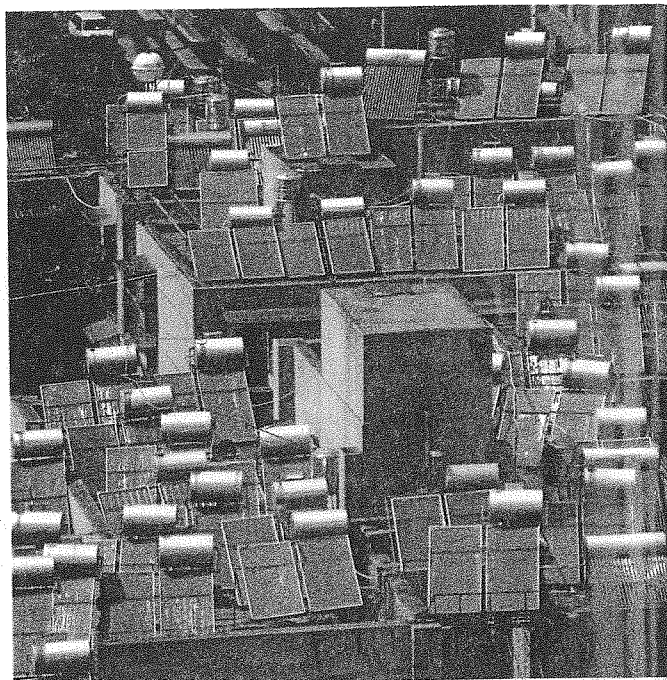
building a solar-module manufacturing facility in the city to support the project. While financial details were not released, news of the deal caused First Solar's stock to jump 11% on the day of the announcement. "This major commitment to solar power is a direct result of the progressive energy policies being adopted in China to create a sustainable, long-term market for solar and a low-carbon future for China," First Solar CEO Mike Ahearn said in a statement.

China, the world's leading producer of greenhouse gases, is taking an aggressive path to develop alternative sources of energy. Already the world's leading generator of hydropower—a renewable but sometimes controversial power source because of the impact on river ecosystems—China now aims to be the front runner in wind- and solar-power generation. In 2007 the government directed that by next year at least 3% of large power companies' generating capacity should come from renewable sources (excluding hydropower); this target jumps to 8% in 2020. That may not sound like much, but according to a recent study by the China Greentech Initiative, a coalition of Chinese and foreign businesses, NGOs and government organizations, environmental technologies including renewable energy could become a \$1 trillion market in China by 2013. In a recent commentary, Pulitzer Prize-winning journalist and author Thomas Friedman wrote that China's decision to go green "is the 21st-century equivalent of the Soviet Union's 1957 launch of Sputnik."

The fast-growing country's huge appetite for electricity is behind the push. While China's total power capacity will nearly double by 2020, the amount that could come from wind and solar is expected to jump more than fivefold, aided by significant government assistance. Beijing announced in March it will subsidize 50% of costs for certain solar-panel projects, and 70% in remote regions.

But as often happens in China, this potential bonanza could prove to be a

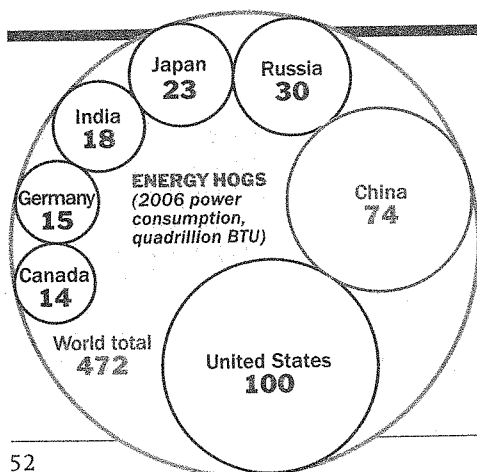
Sunny side up Solar-powered water heaters, which help cut electricity bills, are proliferating throughout China, right; a technician works on solar-cell assembly at a Suntech Power factory in Wuxi, far right



mirage for foreign companies. The country's policymakers are nurturing a domestic alternative-energy industry on a massive scale. China is home to more than 100 wind-turbine manufacturers and some 400 solar-panel companies. The country has quickly grown into the world's largest maker of photovoltaic cells. Yet more than 95% of PV cells produced by China in 2008 were exported, indicating the country's output far exceeds domestic demand. Not surprisingly, foreign companies think they are being blocked from the mainland market. The European Union Chamber of Commerce in China has complained China has erected alternative-energy trade barriers, focusing specifically on the treatment of wind-turbine makers. In a position paper released in September the group said, "The use of bidding requirements to bar international [wind-turbine] companies from competing is a cause for grave concern for these players who have all invested heavily in the market to live up

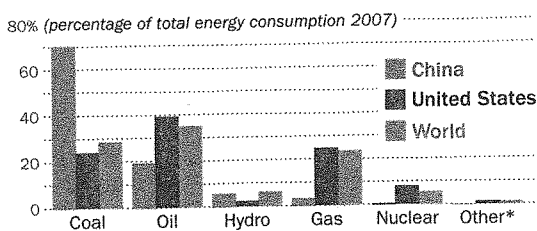
to stringent local content requirements."

Paulo Fernando Soares, China chief executive for Indian wind-turbine maker Suzlon Energy, says his company has successfully bid for provincial-level projects, but Suzlon and all other foreign firms have been shut out of national-level wind-base projects in Gansu, Hebei and Inner Mongolia. While the Chinese manufacturers are able to sell turbines cheaper than foreign firms, Soares argues they can't match foreign-made equipment in terms of reliability and overall track record. "The Chinese government has decided that they want to develop wind bases, that they want to promote a local industry and that they want to have local suppliers working in those big wind bases," he says. "Then the Chinese government says the foreign companies are so much more expensive than the local companies. If the turbine price is the only selection criteria, then fine. If you take into account risks and performance and tariffs and everything, I

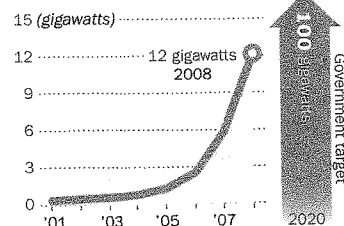


Cleaner Future? China burns a lot of dirty fuel, but green

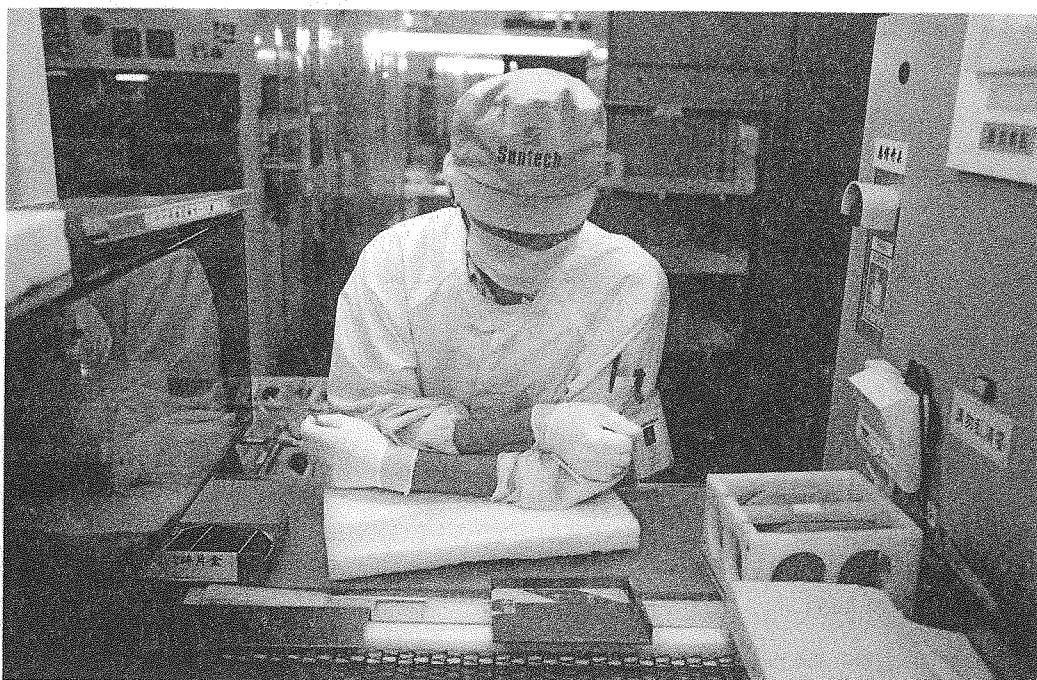
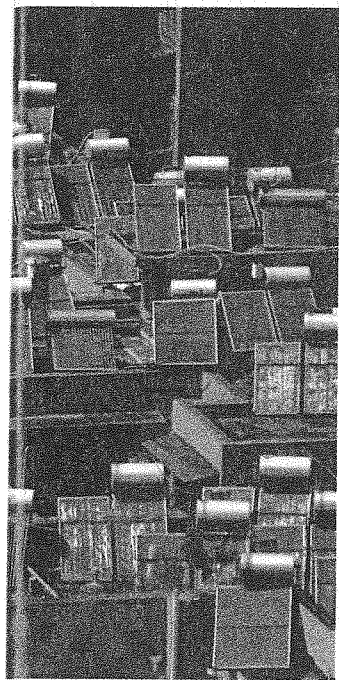
WHERE THE POWER COMES FROM



CHINA'S WIND-POWER CAPACITY



Sources: The World Bank; BP Statistical Review of World Energy June 2009; Energy Information Administration; The China Greentech Initiative analysis; China Wind Power Repc



can tell you in most of the cases, if not all of the cases, the international suppliers are more competitive than the local suppliers."

China's Ministry of Commerce rejected the European chamber's complaints of protectionism, saying the country tries to offer a level playing field for all foreign and domestic businesses. But because China has not signed the World Trade Organization agreement that limits protectionism for government procurement, foreign governments have little recourse. China's National Development and Reform Commission said in June that except in cases where the necessary technology is unavailable domestically, funds from the country's \$586 billion stimulus package should buy Chinese-made equipment.

Soares points out that Suzlon has built a factory in Tianjin with more than 900 employees to satisfy Chinese requirements for 70% local parts content in turbines. "They want to promote local industry. But

then the question is, What is local?" says Soares. "More than 95% of my employees are Chinese. I'm an investor here, a producer here and pay taxes here. So why is there this difference?" Adding insult to injury, Chinese firms are proving to be tough competitors in markets outside China's borders. In Germany, where government subsidies helped stimulate global solar-panel production, an industry association is investigating claims that Chinese panelmakers are dumping their products. Non-Chinese solar firms complain they are undercut in European and American markets by Chinese companies selling similar products for 30% less than rivals. The dispute has the potential to increase trade frictions between China and the West. Earlier this year, U.S. customs officials ruled that imported solar panels were subject to a duty of 2.5% (panel imports were previously duty-free).

Shi Zhengrong, founder and CEO of Suntech Power, China's biggest solar-panel maker, says his company doesn't sell panels below cost anywhere in the world. And he points to First Solar's Ordos deal as evidence that foreign firms can succeed on the mainland. "As long as companies have a competitive renewable-energy technology and product offering," he says, "there will definitely be opportunities in the Chinese market."

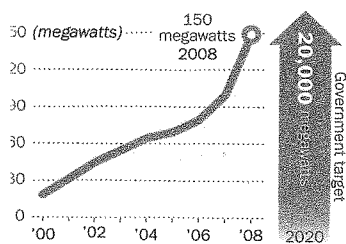
Some overseas firms insist that China is simply repeating an economic development strategy that has propelled the country's rapid progress in many other manufacturing sectors. The country has been able to use the lure of huge potential markets to entice foreign companies to hand over

technology and know-how in exchange for lucrative deals, later using that knowledge to produce competitive products cheaper than those of overseas originators. Foreign companies built the generators for the first stage of the massive Three Gorges hydroelectric dam, but the generator contracts required the foreign makers to transfer technology to Chinese partners, who took the lead in later phases of construction. A similar pattern appears to be playing out in alternative energy. Foreign wind-turbine manufacturers held nearly 60% of the Chinese market in 2006. By last year that position was reversed, with Chinese firms taking 74% of new installations, says Jun Ying, chief China representative for the consulting firm New Energy Finance. In fact, the number of Chinese turbine manufacturers has expanded so rapidly that the government, fearing a glut, warned in October that applications for new factories might not be approved.

Given the number of foreign companies that have set up their own facilities in China, the government is unlikely to let them fail completely, says New Energy Finance's Ying. "If they have manufacturing capacity in China, they generate GDP, generate tax revenue, generate employment, I do not see a reason why the Chinese government would let them die," he says. "A parent may like one child more than the other, but at the end of the day I think they will continue to do well and continue to do business in China." With the rest of the global economy still stagnating, life as China's stepchild may be the best some international firms can hope for. ■

Turbines are growing

CHINA'S SOLAR-POWER CAPACITY



Source: Energy World. *Includes solar, wind, geothermal and biomass

The climate change atlas

On our environment site
An interactive version of the map
www.guardian.co.uk/environment

Floods, drought, famine ... the face of a 4C hotter world in 2060

Forest fire
High forest fire danger, especially in the US, Mexico, south and East Africa, east and south Australia, southern Europe, the Sahel, east of the Andes in south America

Crops
Maize and wheat yields reduced by up to 40%
Soybean yield could decrease, especially in the Americas, southern and eastern Asia
Decrease in rice yields of up to 30% in China, India, Bangladesh and Indonesia

Water availability
Up to 70% reduction in water run-off in the Mediterranean, southern Africa and South America

Sea level rise
Could combine with storm surges to pose threat to the Netherlands and south east UK
In 2075 an extra 150m people per year could be flooded - 56m on Indian Ocean coast, 25m along east Asian coast, 33m along the SE Asian coast, Africa, the Caribbean, Indian ocean and Pacific islands also vulnerable

Glacier melt
Half of Himalayan glaciers significantly reduced by 2050. Areas that traditionally rely on glacial melt water will be seriously affected. Includes the Indus river basin and 23% of the population of China
Many of South America's glaciers could disappear. Peru's Cordillera Blanca summer run-off reduced by up to 69%

Marine
Ocean acidification impacts on fishing industry and fish supplies. Loss of coral reef habitats would prove disastrous for coastal communities relying on subsistence fishing of reef species

Drought
Drought events occur twice as frequently across southern Africa, SE Asia and the Mediterranean basin

Permafrost
Almost complete disappearance of near surface permafrost from northern Siberia. Reduction of permafrost in Canada and Alaska. Houses and towns built on the permafrost at risk

Ice sheet melt
If the West Antarctic ice sheet melts, it would contribute another 3.3 metres to long-term sea-level rise around the globe
Greenland's ice sheet has a 60% likelihood of irreversible decline - long-term this would result in a sea-level rise of 7 metres globally

Tropical cyclone
Tropical cyclones will be more destructive and intense. As global population increases, there will be greater losses to storms and hurricanes. For major cyclone disaster, flooding from storm surges has been the major cause of death

Extreme temperature
Hottest days of the year could be as much as 6C warmer over highly populated areas in east China
Hottest days of the year could be as much as 10-12C warmer over eastern north America, affecting Toronto, Chicago, Ottawa, New York and Washington DC
Europe could experience hottest days of the year 8C warmer

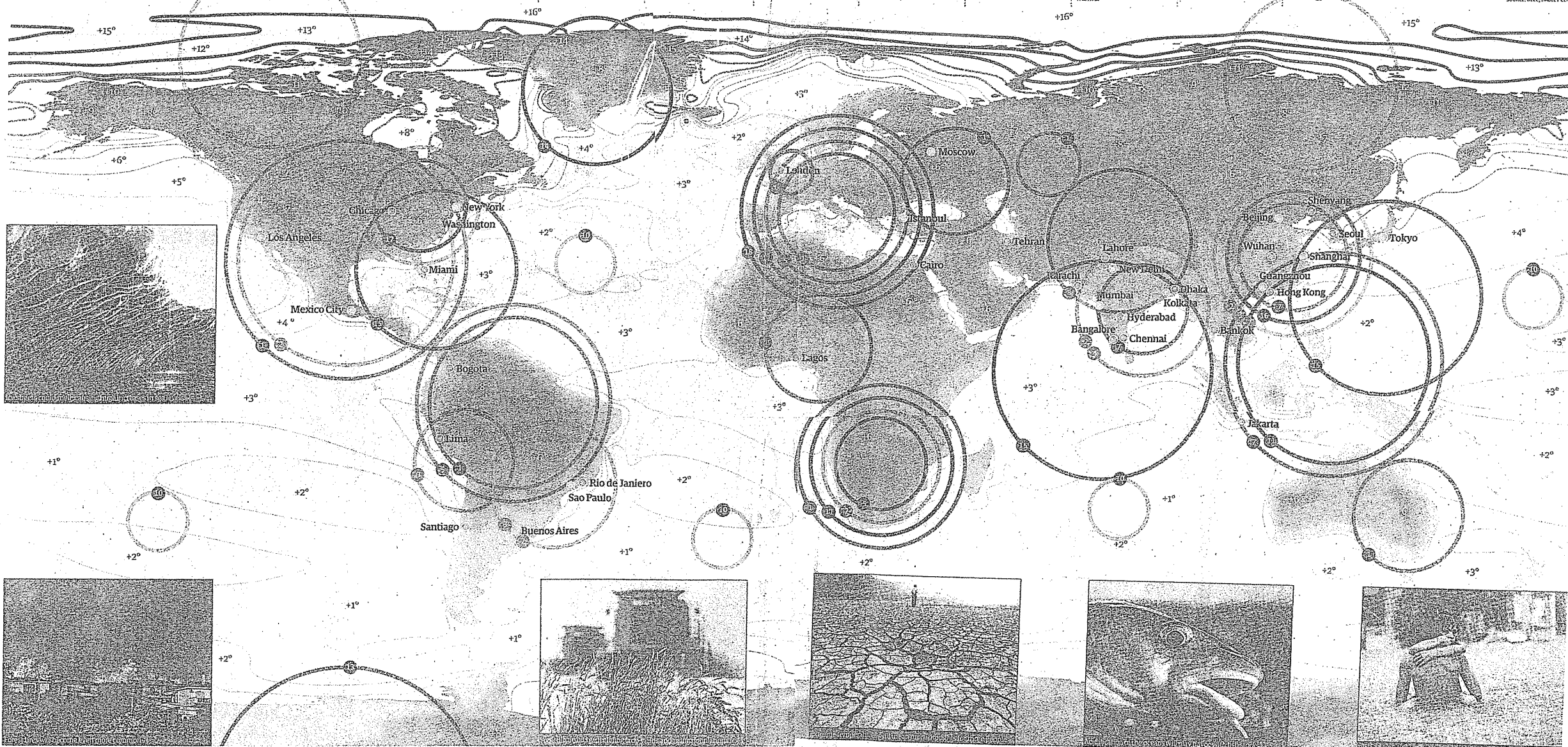
Disease
Overall increase in diarrhoea, diseases such as malaria, malnutrition and the health impacts of extreme weather, such as drought

Change in temperature from pre-industrial climate, °C

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

City population of 10 to 20 million
City population of 5 to 10 million

SOURCE: BCCG, HADLEY CENTRE



David and Ed Miliband warn of 'catastrophe' if there is no deal at climate talks in Copenhagen as the UK publishes a map of what it might look like

David Adam and Allegra Stratton
The government yesterday raised the political stakes on climate change when it published a new map of the world that details the likely effects of a failure to cut greenhouse gas emissions.
The map shows the impact of an average 4C rise in global temperature, which John Beddington, the government's

chief scientist, said would be "disastrous". A study by the Met Office last month said such a 4C rise could come as soon as 2060 unless urgent and serious action was taken to reduce emissions.
The map was launched to coincide with the London Science Museum's "Prove It!" climate change exhibition by David Miliband, the foreign secretary, and his brother Ed Miliband, the energy and climate change secretary. It comes

in advance of crucial political talks on climate change in December in Copenhagen, where British officials will push for a new global deal to curb emissions.
The Milibands said a new deal needed to be strong enough to limit global temperature rise to 2C, although many involved in the negotiations privately believe this to be impossible. A joint press release from the government and the Met Office to promote the map says

the government is aiming for an agreement that limits climate change "as far as possible to 2C".
The map's release marks a significant shift in political discourse on climate change, with many politicians until recently unwilling to discuss the possibility of a failure to hit the 2C target.
The foreign secretary warned yesterday that the Copenhagen talks were "the most complicated international negotia-

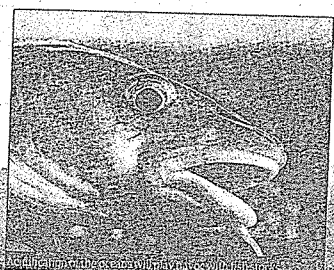
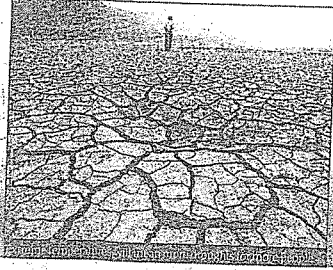
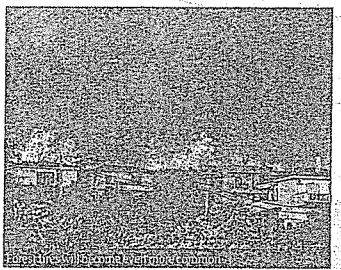
tions ever attempted". He predicted that unless climate change was slowed there would be high pressure on water and food shortages.
In their second joint press conference on international efforts to secure a deal in Copenhagen - now 45 days away - the Milibands stressed the danger posed by a political failure at the talks.
"We cannot cope with a 4C world. This map illustrates the scale of the

challenge facing us," the foreign secretary said. "To tackle the problem of climate change all parts of government and societies must work together to keep global temperatures to 2C."
Ed Miliband said: "Britain's scientists have helped to illustrate the catastrophic effects that will result if the world fails to limit the global temperature rise to 2C. With less than 50 days left before agreement must be reached,

the UK is going all out to persuade the world of its need to raise its ambitions, so we get a deal that protects us from a 4C world."
The map, produced by the Met Office Hadley Centre, is based on current rates of climate change and not slowed. It shows that the rise will not be evenly spread across the globe, with temperature rises much larger than 4C in high

latitudes such as the Arctic. Because the sea warms more slowly, average land temperature will increase by 5.5C, which scientists said would shrink agricultural yields for all major cereal crops in all major regions of production.
A 4C world would also have a major impact on water availability, with supplies limited to an extra billion people by 2080. It could also be very bad news for the Amazon, with some computer

models predicting severe drying and subsequent die-back.
One of the biggest, more subtle, effects could be on the way the world's oceans and ecosystems absorb carbon. About half of our carbon emissions are currently soaked up in this way, which helps put the brake on global warming. In a 4C world, scientists say, the amount of emissions that would be re-absorbed in this way could shrink to 30%.



The nuclear option: India pins hopes on cleaner, thorium-powered plants

First reactor to be running by the end of the decade
Abundant fuel could be an alternative to fossil fuels

Raseeh Rahman Mumbai

India has announced plans to build a prototype nuclear power plant that uses the fuel thorium, which is seen as an innovative, "safer", alternative to uranium. Officials are selecting a site for the reactor, which would be the first of its kind or using thorium for the bulk of its fuel. They plan to get the plant up and running by the end of the decade. The development of workable and large-scale thorium reactors has been a dream of nuclear engineers for decades. For some environmentalists it is a feasible option, an alternative to fossil fuels. Proponents maintain the fuel has considerable advantages over uranium. Thorium is more abundant on Earth, and exploitation of it does not involve the release of large quantities of carbon dioxide. It is viewed, therefore, as less dangerous for the climate than fossil fuels such as coal and oil.

Ratan Kumar Sinha, director of Bhabha Atomic Research Centre (BARC), in Mumbai, said his team was completing construction plans for the new, large-scale, experimental reactor, and were doing "confirmatory tests" on the design. "The basic physics and engineering of the thorium-fuelled advanced heavy water reactor (AHWR) are in place, and the design is ready," said Sinha.

Once the search for a site, over six months, is completed (the location will probably be next to an existing nuclear power plant) another 18 months will elapse while regulatory and environmental impact clearances are obtained before building work starts.

"Construction of the AHWR will begin after that, and it would take another six years for the reactor to become operational," Sinha added.

If all went to plan, the reactor could be operational by the end of this decade. The reactor is designed to generate 300MW of electricity - about a quarter of the output of a typical new nuclear plant in the west.

Producing a workable thorium reactor would be a massive breakthrough in energy generation. Using thorium - a naturally occurring moderately radioactive element named after the Norse god of thunder - as a source of atomic power is not new technology. Promising research was carried out in the US in the 1950s and 60s, but then abandoned in favour of using uranium.

Those who advocate the use of thorium say the switch was due at least partly to national nuclear power programmes in the US and elsewhere being developed with a military purpose in mind: they would provide access to a source of plutonium for nuclear weapons. Unlike uranium-fuelled reactors, those using thorium would not lead to a proliferation of weapons-grade plutonium.

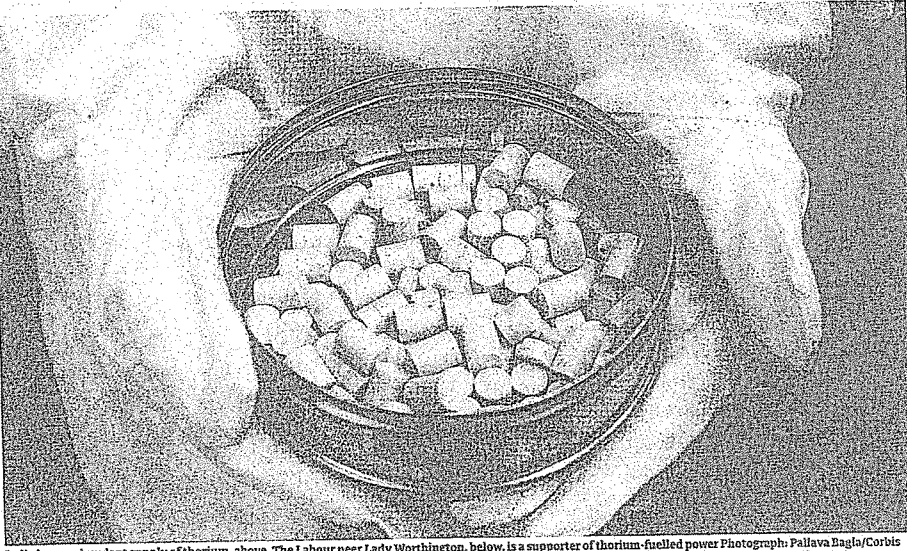
Also, under certain circumstances, the waste from thorium reactors would be less dangerous and remains radioactive for hundreds rather than thousands of years, say scientists.

Those aspects are a considerable plus for governments worried about how to deal with nuclear waste and concerned about the possibility of rogue governments or terrorists getting their hands on plutonium.

With the world's supply of uranium rapidly depleting, attention has refocused on thorium, which is three to four times more abundant and 200 times more energy dense than uranium.

"Given India's abundant supply of thorium it makes sense for [the country]

'Given India's abundant supply of thorium it makes sense to develop reactors'



India has an abundant supply of thorium, above. The Labour peer Lady Worthington, below, is a supporter of thorium-fuelled power. Photograph: Pallava Bagla/Corbis

to develop thorium reactors," said the Labour peer Lady Worthington, who is patron of the Weinberg Foundation, which promotes thorium-fuelled nuclear power.

She added: "However, many of the advantages of thorium fuel are best realised with totally new reactor designs, such as the molten salt reactor developed by Alvin Weinberg in the 1960s. I hope India will also commit to exploring this option."

India has the world's largest thorium deposits, and, with a world hungry for low-carbon energy, has its eyes on a potentially lucrative export market for the technology.

For more than 30 years India's nuclear research programme had been subject to international sanctions since its controversial 1974 nuclear tests. But after losing its pariah status three years ago following the Indo-US nuclear deal, India has been keen to export indigenous nuclear technology developed in research centres such as BARC.

However, there are still restrictions. One problem is the trigger fuel that the reactor needs to start operations.

In the original design this was a small quantity of plutonium. The new reactor's trigger would be low-enriched uranium (LEU) - which India is permitted to import under the 2008 Indo-US deal.

"The AHWR will eventually have design flexibility, using as fuel either plutonium-thorium or LEU-thorium combinations," said Sinha. "The LEU-thorium version will make the AHWR very much marketable abroad, as it would generate very little plutonium... making it suitable for countries with high proliferation resistance."

The LEU-thorium design is at the pilot stage. For the first time last year, BARC tested the thorium-plutonium combination at its facility in Mumbai, but the centre is some way from doing the same for the thorium-LEU combination.



A safer way to generate energy?

Thorium is a radioactive chemical element that could in theory be used to generate large quantities of low-carbon electricity in future decades.

Compared with the uranium that powers today's nuclear plants, thorium is more abundant and widely distributed in the Earth's crust. It is not prone to runaway chain reactions that can lead to nuclear disasters and its waste products remain dangerous for a much shorter period.

There are various different ways that thorium could be used to generate energy. A plant being developed in India uses solid thorium fuel in water-cooled reactors similar to those found in today's uranium-based power plants.

A completely different approach being explored in China and the United States is the liquid fluoride thorium reactor (LFTR or "lifer").

Advocates of this technology argue that its potential is far greater than the water-cooled approach, partly because LFTRs could extract a higher proportion of energy from the thorium fuel.

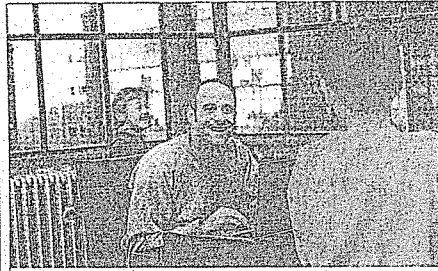
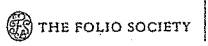
This year saw the launch of the Weinberg Foundation, a pressure group seeking to accelerate the development of thorium technology. Nonetheless, it's unlikely that thorium will provide much of the world's energy before 2030. Duncan Clark



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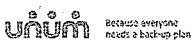
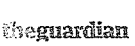
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How to feed the world

Business as usual will not do it



1 billion people will go to bed hungry.

This failure, already dreadful, may soon get worse. None of the underlying agricultural problems which produced a spike in food prices in 2007-08 and increased the number of hungry people has gone away. Between now and 2050 the world's population will rise by a third, but demand for agricultural goods will rise by 70% and demand for meat will double. These increases are in a sense good news in that they are a result of rising wealth in poor and middle-income countries. But they will have to happen without farmers clearing large amounts of new land (there is some scope for expansion, but not much) or using up lots more water (in parts of the world, water supplies are stretched to their limit or beyond). Moreover, they will take place while farmers also wrestle with the consequences of climate change, which, on balance, will do more harm than good to farmland round the world.

It may be too late to avoid another bout of price rises. Despite a global recession and the largest grain harvest on record in 2008, food prices are heading up again. Still, countries have a brief window of opportunity in which to set long-term policy goals without being distracted by panic measures. They need to do two things: invest in the productive capacity of agriculture and improve the operation of food markets.

Governments have done one but not the other. Over the past year investment has risen faster than anyone expected. But distrust of markets and a reaction against farm trade are growing. Unless governments restrain those impulses, they will undermine the gains from rising investment.

The quarter-century slumber

For most of the past 25 years, investment in agriculture has declined relentlessly. In 2005 most developing countries were investing only around 5% of public revenues in farming. The share of Western aid going to agriculture fell by around three-quarters between 1980 and 2006. This disinvestment laid waste to productivity. During the Green Revolution of the 1960s, staple-crop yields were rising by 3-6% a year. Now they are rising by only 1-2% a year; in poor countries, yields are flat.

Fortunately, the food-price spike of 2007-08 shocked governments out of their quarter-century of neglect. The World Bank and many rich countries have doubled the money they put into poor countries' farming. In the poor countries themselves, agriculture has gone from being a sideshow for the government—something the minister of agriculture does—into its main event, which everyone needs to worry about. This is as it should be: farming is far and away the single most important economic activity in most poor places.

Some of the new splurge of public money is going on safe-

ty-net programmes for poor farmers, which are justified on anti-poverty grounds: three-quarters of the world's poorest live in rural areas. But the money will pay dividends in the long run only if it improves farmers' access to market. Lack of reliable markets is the biggest barrier to rural development, since without them farmers have little incentive to grow more. So the increase in rural road-building is welcome, as are measures to improve the operations of local markets by (for instance) spreading price information and building grain stores. There is also a case for temporarily subsidising better seeds and fertilisers in places where local markets are failing to provide them: this is an example of correcting market failure.

Boosting world food production without gobbling up land and water will also require technology to play a larger role in the next 40 years than it has in the past 40, when people have been more or less living off the gains of the Green Revolution. Technology means a lot of things: drip irrigation, no-till farming, more efficient ways to use fertilisers and kill pests. But one way of raising yields stands out: developing genetically modified (GM) crops that, for example, use less water. Here, too, public bodies can overcome resistance. GM crops may be more acceptable if they come from government institutes than big companies or if the seeds are given away, rather than sold (which may be why Monsanto is doing that; see pages 85-87).

I'm not all right, Jack

There is, however, a danger inherent in all this government activity: the temptation of self-reliance. The food-price rise of 2007-08 made all countries worry about "food security"—quite rightly. But over the past year "food security" (ensuring everyone has enough to eat) has shaded into "food self-sufficiency" (growing it all yourself). Self-sufficiency has become a common policy goal in many countries (see pages 76-78).

In itself, self-sufficiency is not bad. If poor countries have a comparative advantage in producing their own food, they should do so (and that will often be the case). The problem is that the new rhetoric of self-sufficiency coincides with a growing distrust of markets and trade. Grain importers no longer trust world markets to supply their needs. "Land grabbers" are snapping up land abroad to use for food production. Everywhere, governments are more involved in farming through input subsidies. In these conditions self-sufficiency could easily sprout protective walls.

That would be in nobody's interest. As Europeans have demonstrated over decades, pursuing self-sufficiency above all else is extremely wasteful. Self-sufficiency would also lock in patterns of agricultural production just when climate change is affecting different parts of the world differently, making trade between them all the more important.

The food-price trauma of 2007-08 is persuading some countries to say that they need to divert part of their wealth to subsidise food so they can be self-sufficient and avoid future crises. But the demands of feeding 9 billion people in 2050 tell a different story: farming needs to be as efficient as possible. That requires markets and trade. Investing in agriculture is a boon; rejecting agricultural markets would be a disaster. ■