building a 210-megawatt demonstration of a pebble-bed reactor, led by researchers at Tsinghua University in Beijing. It could come online by next year, marking a first for safer 'generation IV' reactor designs.

The Chinese Academy of Sciences is also working with the US Department of Energy on molten-salt reactors, which were originally developed and tested at Oak Ridge National Laboratory in Tennessee in the 1960s. Researchers at the Massachusetts Institute of Technology in Cambridge are pursuing a partnership to advance an entirely new design that includes elements of both molten-salt and pebble-bed reactors. And the relative newcomer TerraPower, which is based in Bellevue, Washington, and funded by Microsoft co-founder Bill Gates and others, has signed a memorandum of understanding with the China National Nuclear Corporation (CNNC) to pursue the company's 'travelling wave reactor', which is designed to minimize the need for uranium enrichment.

These partnerships illustrate the advantages of international collaboration. China thinks big and moves quickly, and the world may one day reap the benefits. But the country's zeal for advanced nuclear technology has an ominous side: China's latest five-year plan also promotes the reprocessing of nuclear fuel. CNNC officials are currently negotiating with the French nuclear giant Areva to build such a facility.

The promise of nuclear reprocessing has not panned out. The idea dates back to the beginning of the nuclear era, when officials feared a shortage of uranium resources. Plutonium extracted from spent fuel would be redeployed in breeder reactors, which produce more fuel than they consume. But as it turns out, there is more than enough uranium for the foreseeable future. Moreover, the technologies proved expensive, and the risks became all too clear in 1974 when India used reprocessed plutonium in its first nuclear bomb.

For all of these reasons, the United States and many other nations abandoned the idea decades ago. The United Kingdom is closing its reprocessing operations, and the world would be a safer place if countries such as France and Japan followed suit. China should abandon reprocessing before the inevitable bureaucratic momentum builds up. Instead, the country should focus on reducing costs and developing technologies that might enable nuclear energy to play a larger part.

"China thinks big and moves quickly, and the world may one day reap the benefits."

As it stands, the short-term outlook is mixed. Some 444 nuclear reactors currently operate around the world, accounting for as much as 11% of global electricity production. Another 64 are under construction, including 22 in China. But many of the existing reactors are getting old and will need to be replaced.

Meanwhile, the public and politicians in many countries are warier than ever after the 2011 Fukushima accident in Japan. An optimistic projection by the International Atomic Energy Agency suggests that global nuclear-power capacity could increase by a factor of 2.5 by 2050. In a pessimistic scenario, the agency suggests that overall nuclear-power production could remain roughly flat.

New reactors have struggled to compete with other forms of energy production, and perhaps the biggest barrier is the huge upfront cost. It is simpler, faster and cheaper, at least in the short run, to build natural-gas-fired power plants, or to install wind turbines and solar systems.

The US Department of Energy is funding nuclear-energy research, with the support of lawmakers on both sides of the aisle in Congress. But what nuclear power really needs is a comprehensive climate policy that puts a price on carbon emissions and rewards all low-carbon energies. Short of that, the nuclear industry's best hope may be China. ■

Fat lot of good

Humans' exceptional ability to burn through calories fuels our evolution.

In an interview last September with *Cyclist* magazine, five-time winner of the Tour de France, Miguel Indurain, was asked about his extraordinarily low heart rate, which story after story had claimed was as low as 28 beats per minute. "Is it true?" the interviewer asked.

"One day we did a medical test and it read 28, so there is some truth in it," Indurain said. "But normally it was a little bit higher." By normally, the cyclist meant that it was usually 30 or 32 beats per minute. And although that have might have been normal for him, it is extraordinary compared with that of the average adult, whose heart bumps along at closer to 60–100 beats per minute.

Indurain is said to have near-super-human heart and lung capacity to go with his glacial pulse. He may also have an unusually low metabolism — a common way to estimate that particular physiological measure is simply to look at the heart rate. The more the heart pumps, the estimate assumes, the faster the body's cells and tissues will be exhausting their reserves. If that is true, then having a slow metabolism would merely confirm that Indurain has a special physiological status. For as a species, humans tend to burn through calories as if they are about to go out of fashion.

We humans are a conundrum to physiologists when it comes to our energy use, because we seem to have evolved an ability to have our cake and eat it, too. Compared with our primate cousins, we breed more and have larger brains — both of which should sap our energy — and yet we live for longer.

This week, biologists offer an explanation. And it is similar to Indurain's answer when he was asked to explain his success on the roads: we simply work harder.

In experiments described online on 4 May, scientists took direct measurements of daily energy use in more than a hundred people and in all other known species of great ape (H. Pontzer *et al. Nature* http://dx.doi.org/10.1038/nature17654; 2016). Chimpanzees, bonobos, gorillas and orangutans all failed to keep up. Every human expended hundreds of kilocalories a day more than any other ape, and the difference is down to greater metabolic activity in our organs.

In other words, humans have evolved to use more energy. We are the original consumer society: our increased demand for physiological energy is driven by our more efficient way of walking, the energy-dense foods such as meat and tubers we have found, and the methods of cooking we have invented and adopted.

The unusually large energy budget of humans presents both an opportunity and a threat. For a start, it helps to power — and to explain the development of — our unusually large and concomitantly energy-hungry brains. We have always been proud of our large brains. Indeed a century or so ago, men of science (and they usually were all men) would routinely measure human heads and weigh their brainy contents to prove our dominance over the beasts. (They did this as well as making false claims on the primacy of certain human groups over others.) But how we found the fuel to maintain such an expensive cognitive prize, where other primates have not, has long been a puzzle.

Then there is the risk. To have a body that needs to be fed more just to exist is a dangerous strategy in lean times, just as use of gas-guzzling motor vehicles is considered antisocial in a resource-constrained world.

The human culture of food sharing helps us to keep the tank filled. So too does what seems to be a uniquely human trait among the primates: the ability to maintain significant fat reserves as a contingency. Even at his slimmest, Indurain would have struggled to match the body-fat content of the average chimpanzee. We may curse its effects today, but human fat tissue seems to have evolved to protect us from ourselves and our unquenchable thirst for energy. It's true: those who struggle to keep those fat reserves under control really can blame their metabolism. ■

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